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UNITED FRUIT COMPANY

General Offices: Boston, Massachusetts

MEDICAL DEPARTMENT

SEVENTEENTH
ANNUAL REPORT



1928



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UNITED FRUIT COMPANY

General Offices: Boston, Massachusetts

MEDICAL DEPARTMENT

SEVENTEENTH ANNUAL REPORT



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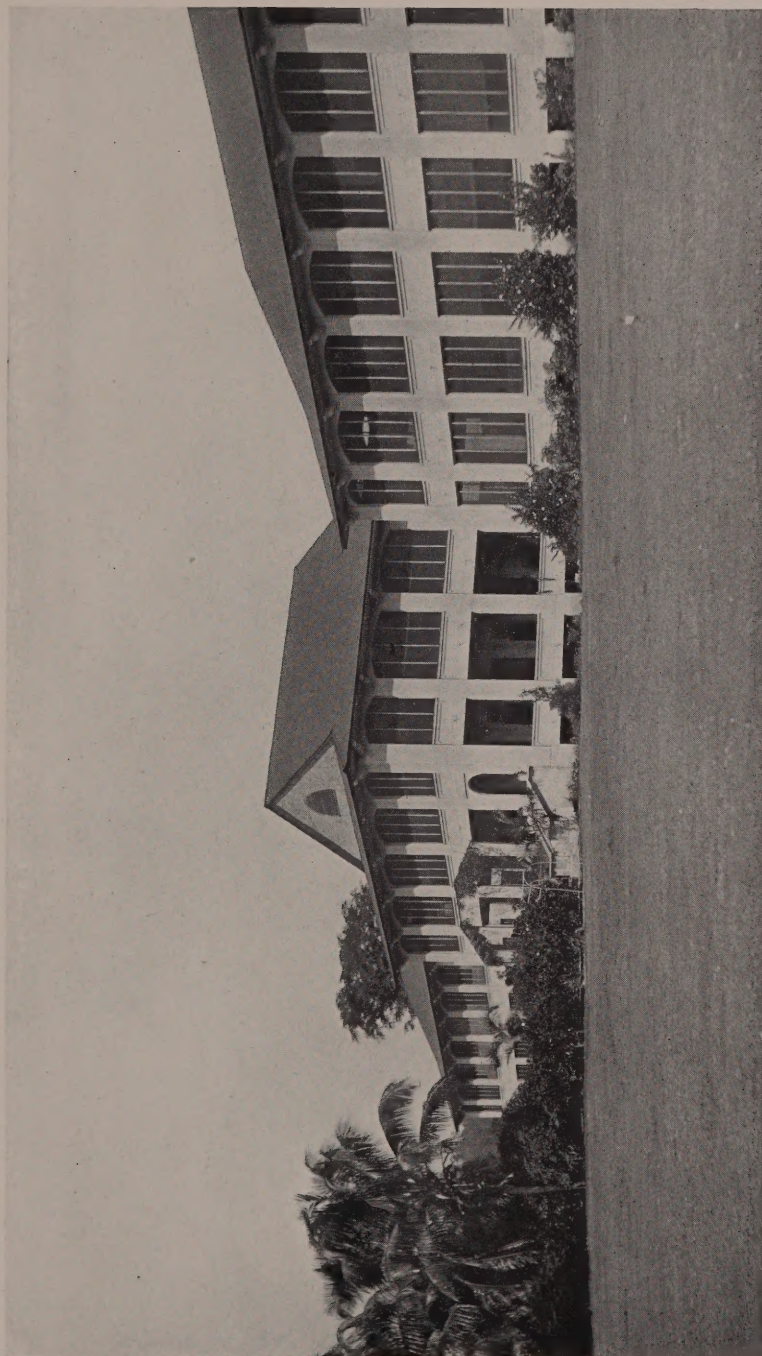
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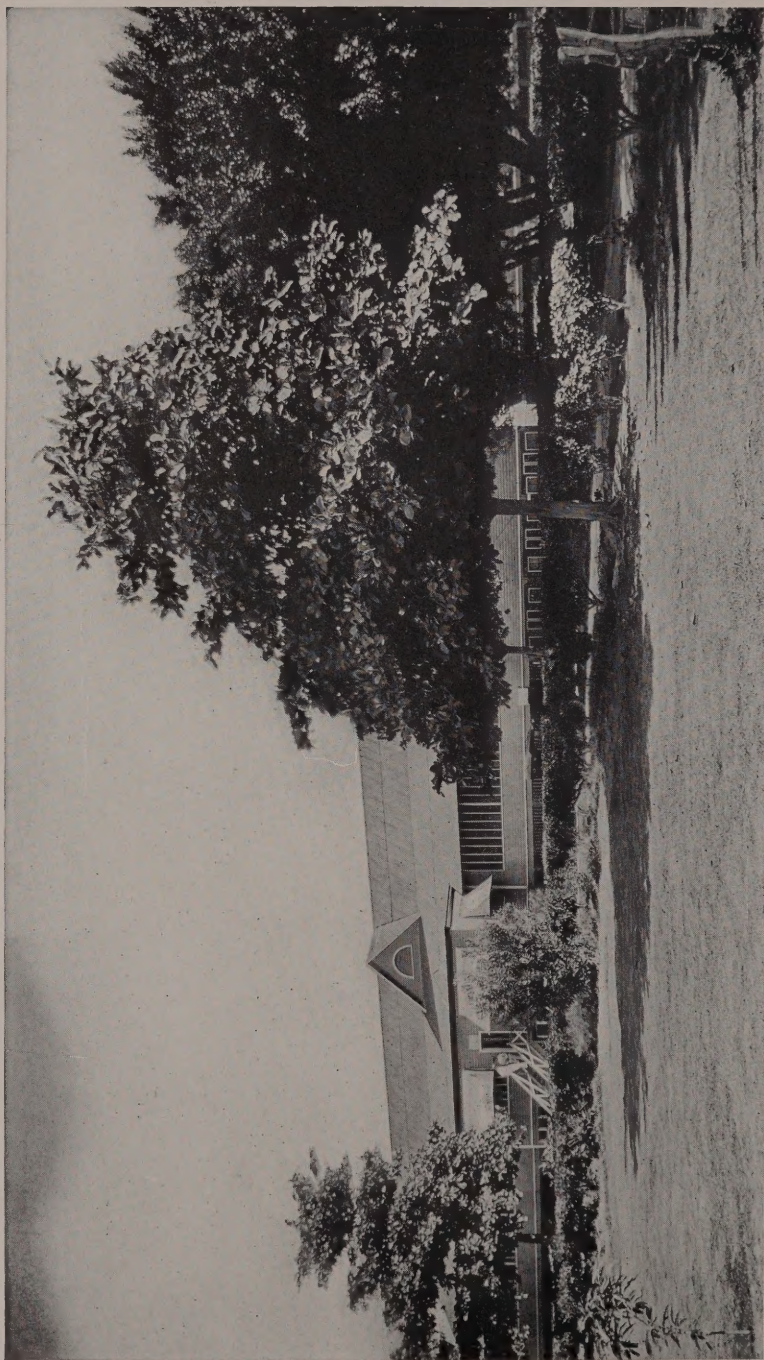
UNITED FRUIT COMPANY HOSPITAL AT PORT LIMON, COSTA RICA



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UNITED FRUIT COMPANY HOSPITAL AT QUIRIGUA, GUATEMALA



UNITED FRUIT COMPANY HOSPITAL AT SANTA MARTA, COLOMBIA



UNITED FRUIT COMPANY HOSPITAL AT PRESTON, CUBA



UNITED FRUIT COMPANY HOSPITAL AT BANÉS, CUBA



TELA RAILROAD HOSPITAL AT TEHA, HONDURAS

REAR VIEW—FOLIAGE PREVENTS OBTAINING SATISFACTORY FRONT VIEW



TRUXILLO RAILROAD COMPANY HOSPITAL AT PUERTO CASTILLA, HONDURAS



LABORERS' WARD IN UNITED FRUIT COMPANY HOSPITAL, BANES, CUBA



X-RAY MACHINE IN UNITED FRUIT COMPANY HOSPITAL, PORT LIMON, COSTA RICA



PRIVATE ROOM IN UNITED FRUIT COMPANY HOSPITAL, PRESTON, CUBA



OPERATING ROOM IN UNITED FRUIT COMPANY HOSPITAL, PRESTON, CUBA



STERILIZING ROOM UNIT IN TRUXILLO RAILROAD COMPANY HOSPITAL, PUERTO CASTILLA, HONDURAS



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MEANS OF TRANSPORTATION TO INLAND POINTS. IT SERVES FREQUENTLY TO BRING PATIENTS
FROM THE INTERIOR TO THE TELA HOSPITAL

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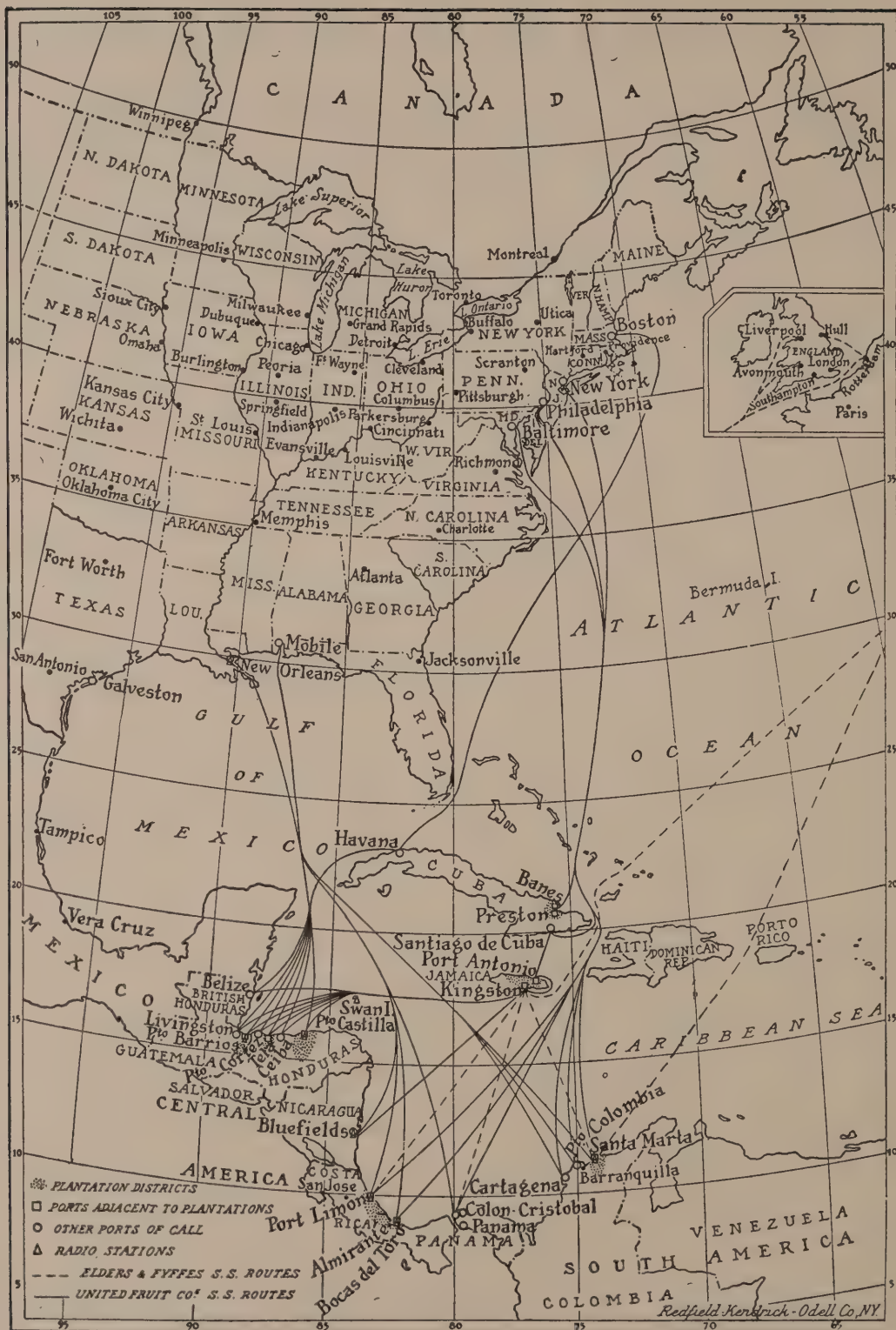
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SECTION I

UNITED FRUIT COMPANY

GENERAL OFFICES, ONE FEDERAL STREET, BOSTON, MASS.

May 1, 1929

MR. V. M. CUTTER, President
United Fruit Company
Boston, Massachusetts

Dear Sir:—

The Annual Report of the Medical Department of the United Fruit Company for the fiscal year ended December 31, 1928, is herewith submitted:

In the Annual Report of 1927 it was stated that considerable progress had been made in controlling the incidence of malaria on the plantations of the United Fruit Company, and it is very gratifying to be in a position to report that this progress has continued.

In a special report on page 94 the program of control is fully outlined and data are submitted to show what has been accomplished. This has been possible only because of the cooperation received from the intelligent employees in the Company's organization.

As they have been impressed with the increased efficiency of the laborers, and are in a position to appreciate the improvement in their health and their living conditions, as well as the benefit to their families, the spirit of cooperation is increasing and we can hopefully anticipate still better results.

We regret to state that Dr. H. C. Clark has found it advantageous to sever his connection with the Medical Department, in order to accept a position as Director of the Gorgas Institute in Panama. We are, however, grateful that his new duties will enable him to maintain a close connection with the Medical Department, as problems in which he is interested have a direct relationship to our own work and we desire to continue to enjoy the benefits of his long and valued experience in solving tropical problems.

With the exception of 6 cases of leprosy among nationals, no quarantinable diseases have developed in any of our divisions during the year; nor has any infectious disease assumed serious epidemic proportions.

The hospital building for the new Chiriqui Land Company Division in Chiriqui Province, Panama, is under construction and it is expected that it will be in full operation in the course of a few months. Several departures in design from the features of the hospitals previously constructed have been made, as will be seen by referring to the floor and elevation plans that appear following pages 31, 61, 91 and 121 of the present Annual Report. The patio principle has been abandoned; the porches are restricted to the ends of the wings; and wide roof and curtain overhangs are provided to protect the walls of the buildings from the direct action of the rays of the sun. Abundant provision has also been made for fresh air. In addition to the windows, a screened space underneath the overhangs is left at the upper part of the side walls of all wards.

The following contributions on research problems carried on in tropical divisions are highly appreciated, and we wish to express our sincere thanks to the authors:

Eugene R. Whitmore, M.D., D.P.H., F.A.C.P.

"The Blood in Blackwater Fever."

Howard Fox, M.D.

"Carate (Pinta) as Observed in Colombia, South America." (This article originally appeared in the Archives of Dermatology and Syphilology, Vol. 18, November, 1928.)

M. A. Barber, Special Expert, U.S.P.H.S., W. H. W. Komp, Associate Sanitary Engineer, U.S.P.H.S., and B. M. Newman, Scientific Assistant, U.S.P.H.S.

"Observations and Experiments in the Panama Division of the United Fruit Company, with Special Reference to Certain Measures for the Control of Malaria."

We are again indebted to Dr. W. M. James, of Panama, for interesting reviews of important publications on Tropical Medicine.

May we call your attention, also, to the numerous contributions by members of our own medical staff?

Your Medical Department wishes to record its gratitude to the officials of the United Fruit Company for their continued cooperation and support.

Respectfully,



MEDICAL DEPARTMENT
17 BATTERY PLACE, NEW YORK

GENERAL MANAGER

COMMENTS ON SOME OF THE MORE IMPORTANT DISEASES OCCURRING IN THE TROPICAL DIVISIONS

PNEUMONIA

Although malaria causes a greater amount of morbidity than any other single infection in the plantations of the United Fruit Company, lobar pneumonia is responsible for the greatest number of fatalities. The incidence of lobar pneumonia does not materially differ from year to year in these localities, as is shown in the following table:

	Lobar Pneumonia Cases Hospitalized	Deaths	Percentage	Total Deaths from all Causes in all Divisions
1926	442	124	28.	737
1927	329	108	32.8	765
1928	368	138	37.5	739

The incidence and mortality rates are apparently influenced by several factors, as follows:

(1) *Race*.—The native Indian, negro, and mixed races seem more susceptible than the white race. In Guatemala, most of the laboring population are native Indians and among them the incidence is greatest.

(2) *Labor Turnover*.—In some of the divisions, particularly Honduras and Guatemala, the labor turnover is high. This constant shifting of labor means a low individual earning capacity; this in turn interferes with the ability of the workers to properly feed and clothe themselves, and consequently lowers their resistance to all kinds of infection.

(3) *Intercurrent Diseases*.—Owing to intercurrent diseases—malaria, hook-worm, syphilis, etc.,—and malnutrition, profound degrees of anaemia are encountered, and there is a consequent lowered resistance to the invasion of pathogenic organisms. The reader is referred to Dr. H. C. Clark's report on haemoglobin surveys, page 245 of this Annual Report.

The autopsy findings reveal—along with extensive areas of consolidated lung tissue—complicating lesions, such as empyema, endocarditis, pericarditis, sinusitis, meningitis, etc., and, not rarely, pneumococcic septicaemia.

(4) *Influenza*.—Unquestionably epidemics of influenza predispose to an increased incidence of lobar pneumonia cases.

Many varieties of methods of treatment have been tried, but none of the specific drugs or measures so frequently recommended has given better results than the drugs and measures formerly utilized. One of the greatest difficulties encountered in the treatment of pneumonia lies in the fact that the disease has reached an advanced stage before the patients are admitted to the Hospital. This reflects the prevailing illiteracy of the native laborers. The best results have been obtained in those cases where treatment has been initiated early in the onset of the disease. In the treatment, the usual routine measures are

followed, such as an abundant provision of fresh air, general supportive measures, and the administration of drugs for the relief of symptoms and for stimulation of the heart; and for the latter the most important is digitalis. Early digitalization by heroic doses is recommended, and the heart should be subsequently supported by smaller doses throughout the acute stages of the disease. Some of our physicians believe that excellent results are obtained by the use of mercurochrome intravenously—10 to 15 cc. of a 1% solution, repeated if necessary; but these favorable effects are brought about only in cases that are treated soon after the onset of the disease. In advanced cases, mercurochrome is not recommended. Other special methods that have been followed, as well as the results obtained, have been referred to in previous Annual Medical Reports of the United Fruit Company.

The incidence of bronchopneumonia is not as high as that of lobar pneumonia, but bears a definite relation to it. In 1928, 130 cases of bronchopneumonia were treated in the hospitals, with 31 deaths (23.85%).

Thirty-three cases of unspecified forms of pneumonia occurred, with 7 deaths.

INFLUENZA

Epidemics of this disease are invariably followed by a series of cases of lobar and broncho pneumonia; and their numbers and gravity usually reflect the character of the epidemic, as to whether it is severe or mild. Epidemics of a mild form of influenza occurred in all but the Cuban divisions during 1928. Altogether, 1,755 cases were treated, with 11 deaths. In those divisions where the influenza assumed epidemic proportions the incidence of pneumonic complications was correspondingly high.

All clinicians who have had extensive experience in the treatment of influenza cases are familiar with the frequent incidence of pulmonary after-effects in the form of capillary bronchitis or low-grade bronchopneumonic conditions that are slow in resolving. In many of these cases splendid results are obtained by the use of preparations of digitalis. In the hospitals of the United Fruit Company the routine treatment is 15 drops of the tincture 3 times daily after meals. By the toning up of the muscular action of the heart, the pulmonary circulation is stimulated, and the passive congestive condition rapidly disappears.

TYPHOID FEVER

During 1928, 78 cases of typhoid fever were treated in the hospitals, and 12 died (15.38%). Of the total number, 43 cases were among non-employees, and accounted for 4 of the deaths. As regards the 35 employees who contracted typhoid fever, the sources of infection in some of them were traced outside of the divisions; others were evidently infected indirectly from carriers who entered the divisions from outside infected foci. In no instance was the source of infection traced to the general water, milk or other food supplies, although in one

instance a local well supply was infected. In the Banes Division more cases were encountered than in any other division, and from Dr. Ariza's report we quote the results of the investigations concerning the manner in which typhoid fever and paratyphoid fever were contracted:

Banes and the surrounding villages (Mulas, Sama, Viguitas, etc.) for many years have been a hot-bed of typhoid fever. We have had, this year, 39 cases with 4 deaths, as against 33 last year with 5 deaths. Every one of our cases has been investigated and the infection traced to its source. We have the satisfaction of being able to prove that none of the cases originated in our property.

Only members of the laborers' population have been attacked by this disease, through the introduction among them of carriers who infected the environment.

Dr. R. A. Hernandez, whom I detailed to investigate, and report on, the sources of infection of all cases of typhoid fever, summarizes his findings as follows:

"Our recent studies of typhoid outbreaks in Banes have brought to light some interesting points, though there is nothing new in the methods of typhoid transmission and investigation.

"It is the policy of the Medical Department in this Division to investigate the source of infection of every case of typhoid fever that enters the Hospital. Our routine method involves obtaining the following data:

1. Residence of patient previous to illness
2. Mode of living
3. Visitors to house where patient lives
4. Nature of diet
5. Source of water and milk supply
6. Hygiene, house and personnel
7. Possibilities of contact

"For the past two years, we have been able to determine exactly the source of transmission in all cases. In one case only, water was the medium of infection. The water supply, a well, became infected through the improper disposal of undisinfected excreta of a typhoid patient. We were able to culture the typhoid bacillus from the well-water. In all the other cases investigated, infection occurred through the medium of flies or from direct contact. It is our belief that effective control measures can be brought about only through education, prophylactic inoculations, and case isolation. In the majority of cases we are dealing with ignorant laborers, and control measures are difficult to put into execution. It is practically impossible to educate all the people living within the radius of the Company's properties and to force upon them prophylactic measures that they do not desire. It is an old custom in Cuba, bred deeply into the people's nature, to meddle with sick people.

"Neighbors will visit daily a case of typhoid fever at the home, notwithstanding the warnings given by the physician to the effect that such contacts may bring infection to themselves.

"Education has only a limited value. We possess, however, a powerful though tedious and expensive weapon in prophylactic inoculations and isolation.

"Local government sanitation laws empower us to enforce inoculation on all persons exposed to infection and to isolate those suffering from typhoid. In 1928 we gave nearly 8,000 injections of typhoid vaccine, which necessitated a great deal of persuasion, time and expense.

"Isolation in the Hospital is expensive, although only a modest charge is made to members of the families of employees.

"A glance at the statistics for the past 4 years would lead us to believe that we are not making progress. Our records show 35 admissions for 1925; 22 for 1926; 33 for 1927; and 39 for 1928. The figures do not necessarily represent an increase in the number of cases of typhoid infections occurring in the Division, but they are indicative of more rigid investigations into the diseases from which the laborers suffer, and a resultant uncovering of a greater proportion of the cases existing in the locality.

"We know that the incidence of typhoid cases can not be prevented in Banes, for the laboring population is constantly changing and the influx is frequently from localities where there are foci of infection."

PARATYPHOID

In 1928, 22 cases occurred in the divisions—7 of them in Colombia, and 8 in Costa Rica. There were 2 fatalities (9.09%). In 1927, 16 cases were reported; also with 2 deaths.

AMOEBCIC DYSENTERY

The incidence of this disease in our divisions appears to be decreasing:

In 1926, 536 cases were treated, and 17 died (3.1%)
" 1927, 424 " " " " 5 " (1.1%)
" 1928, 331 " " " " 3 " (.91%)

Of these cases, 123 originated in the Colombia Division in 1928, as compared to 302 in 1926, and 156 in 1927. This lowered incidence is believed to be directly attributable to the improved drinking-water supply. The plantation is irrigated, and the laborers use the ditches for laundry purposes; formerly, they used the same ditches for their drinking-water supply, also. About 3 years ago wells were driven, throughout the Division, and pumps were provided. The prejudice against the use of well-water by laborers is slowly being overcome, and there is a corresponding decrease in the incidence of the disease. The low mortality rate is unquestionably the result of the method of treatment routinely followed.

In the early days of the construction of the Panama Canal, amoebic dysentery was considered a serious affection, and the mortality rate from it and from its chief complication, amoebic abscess of the liver, was very high. The treatment then followed consisted, for the most part, of colonic irrigations with a great variety of drugs. Among these may be mentioned solutions of quinine, nitrate of silver, potassium permanganate, etc. Appendicostomy and caecostomy were frequently done, and by this means the medicated irrigations were carried out. Preparations of ipecac, in various dosages and different methods of administration, were given orally. Moreover, opiates were freely administered. The results, by all these methods of treatment, were extremely unsatisfactory. Convalescence was greatly delayed, relapses were frequent, the mortality rate was

high; liver abscesses were frequent complications. The colonic irrigations were very tedious to administer and annoying to the patient, as some of them were quite painful.

Following these experiences, the writer introduced the bismuth-subnitrate method of treatment, which proved simple and effective. The patients were confined to bed, placed on a varied liquid diet (excluding eggs), and bismuth subnitrate was given in doses of from 1 to 2 teaspoonfuls in bulk, stirred in a tumbler of plain water, or—better still—effervescent water, 3 or 4 times daily. This treatment was continued until the stools formed and were lessened in number to 3 or 4 daily, whereupon a more generous diet was allowed. As the patient convalesced, the dosages of bismuth were reduced in number to 2 or 3 daily. If constipation developed and no movement occurred for 2 days, castor oil was administered. Generally, within from 3 to 4 weeks the patients were convalescent, and relapses were of rare occurrence. The good results following this method of treatment were believed to be due to the fixation of the sulphur compounds in the colon by the bismuth salt, as the insoluble sulphide salt of bismuth was formed. Many writers believe that sulphur compounds are favorable to the growth of *Entamoeba histolytica*. In any case, within 24 hours after administration the character and the flora of the stools changed, and improvement in the patient's condition soon became evident. Amoebae were rarely found after the 4th day.

According to earlier methods, normal saline irrigations of the colon were routinely used, but later on these were restricted entirely to those cases where the ulcers involved the rectum, and tenesmus was present. Later on, emetine was introduced; and this proved to be a great boon, particularly in the fulminating cases and where liver abscesses threatened. In chronic cases where emetine alone was administered, the results were disappointing, as relapses frequently occurred a few months after the treatment was suspended. In the Canal Zone, therefore, the combined treatment was used—bismuth subnitrate by mouth, and emetine hypodermically. The results were exceedingly gratifying in all cases in which the treatment was carefully carried out and the close cooperation of the patient was obtained. Opiates were restricted to an occasional hypodermic dose of morphine, and this was given only in cases where there were severe pain and tenesmus. Emetine is administered hypodermically in doses of from 1 to 2 grains daily, and never continued over a period involving a total course of more than 9 grains. This was repeated only after an interval of several days. Emetine has a depressing action on the heart, which should be carefully watched during its administration. It also produces symptoms of neuritis when continued over too long a period. This routine method of treatment has been followed in the hospitals of the United Fruit Company.

From time to time new remedies have made their appearance, and their use has been indorsed by eminent authorities. The most important of these drugs are bismuth-emetine-iodide, yatren (anayodin) and stovarsol. All of these drugs

have been given an extended trial in our hospitals, but none has produced the universally good results obtained from bismuth subnitrate and emetine. An occasional case will prove resistant to this method of treatment. In one recent case, the ulcerations were in a dependent acute flexure of the sigmoid, and prolonged tonic treatment in addition to the specific treatment was necessary to effect cure. But it is seldom indeed that we find a case which resists treatment, and relapses are of rare occurrence.

BACILLARY DYSENTERY

In 1928, 82 cases of various forms of bacillary dysentery were treated and 8 (9.76%) of these died; 72 of the cases occurred in the Tela Railroad Company Division, and accounted for 5 of the deaths. The reader is referred to Dr. Nutter's report on an outbreak of food poisoning in this Division (see page 271 of the present Annual Report). We have no specific method of treatment for bacillary dysentery—this depends upon the character of the organism and the severity of the symptoms in the individual case. After the contents of the bowels are evacuated, a restricted liquid diet is ordered; and the administration of large doses of bismuth subnitrate will take care of the majority of the cases. Transfusions of warm normal saline solution are indicated in severe cases.

BERIBERI

The incidence of this disease is increasing in some of our divisions. In 1928, 42 cases were encountered; in 1927, only 31. Of the 42 cases, 13 occurred in the Colombia Division, 18 in the Truxillo Railroad Company Division, 9 in the Preston Division, and 1 each in the Panama and Banes Divisions. Unquestionably, diets deficient in vitamins were directly responsible. In the classes of people among whom these cases occurred, there is an excess consumption of the refined cereal foods, dried salt fish, etc., and an inadequate intake of the unrefined foods in the form of legumes, green vegetables and fresh fruits.

HOOKWORM DISEASE

Although the incidence of this disease is high among the laboring population of all races in the Tropics, the degree of infestation in the localities where the United Fruit Company operates is generally low. Rarely are more than a few worms present in any given case; and in the plantations of the United Fruit Company this disease plays a minor rôle as a direct cause affecting either the morbidity or the fatality rates.

All patients entering the Hospital are routinely examined for hookworm infestation, and treatment is given to all in whose stools ova are found. As this method of procedure has been followed for several years, we rarely encounter a case with an overwhelming infestation, nor even one in which it can be said to play an important rôle in the prevailing anaemia.

Oil of chenopodium is the vermifuge of choice in our hospitals. Thymol, carbon tetrachloride, and tetrachlorethylene have been given thorough trials, but none of these has proved as satisfactory and as safe as chenopodium.

SMALLPOX AND ALASTRIM

It is gratifying to be able to record that not a single case of either of these diseases has been encountered in any of the plantations of the United Fruit Company during 1928.

For several years prior to 1928 alastrim was endemic in the Island of Jamaica. Dr. I. W. McLean reports as follows, for 1928:—

According to the Government's report giving a weekly classification of infectious diseases, we are pleased to say that alastrim has finally disappeared from the Island. However, we still continue to revaccinate our new employees, and the Government still requires vaccination or evidence of recent successful vaccination before allowing passengers from Cuba and other West-Indian islands, as well as Central America, to land in the Island.

DIPHTHERIA

In all, 17 cases of diphtheria were reported, with 2 deaths; 6 from the Tela Railroad Company Division, 10 from Banés, and 1 from the Panama Division; 13 of the cases occurred among native non-employees.

Diphtheria rarely assumes epidemic proportions in the American Tropics, and only in an occasional neglected case does it prove fatal. Owing to its rare occurrence among the native laborers and the mild symptoms generally occasioned by it, several contact cases may occur before a case develops with sufficiently severe symptoms to require medical attention.

Surveys of those exposed reveal a number of people with positive throat cultures, but without evidences of acute illness. In the Tela Railroad Company Division 6 cases were treated in the Hospital, and cultures from contacts developed 28 carriers with positive throat cultures.

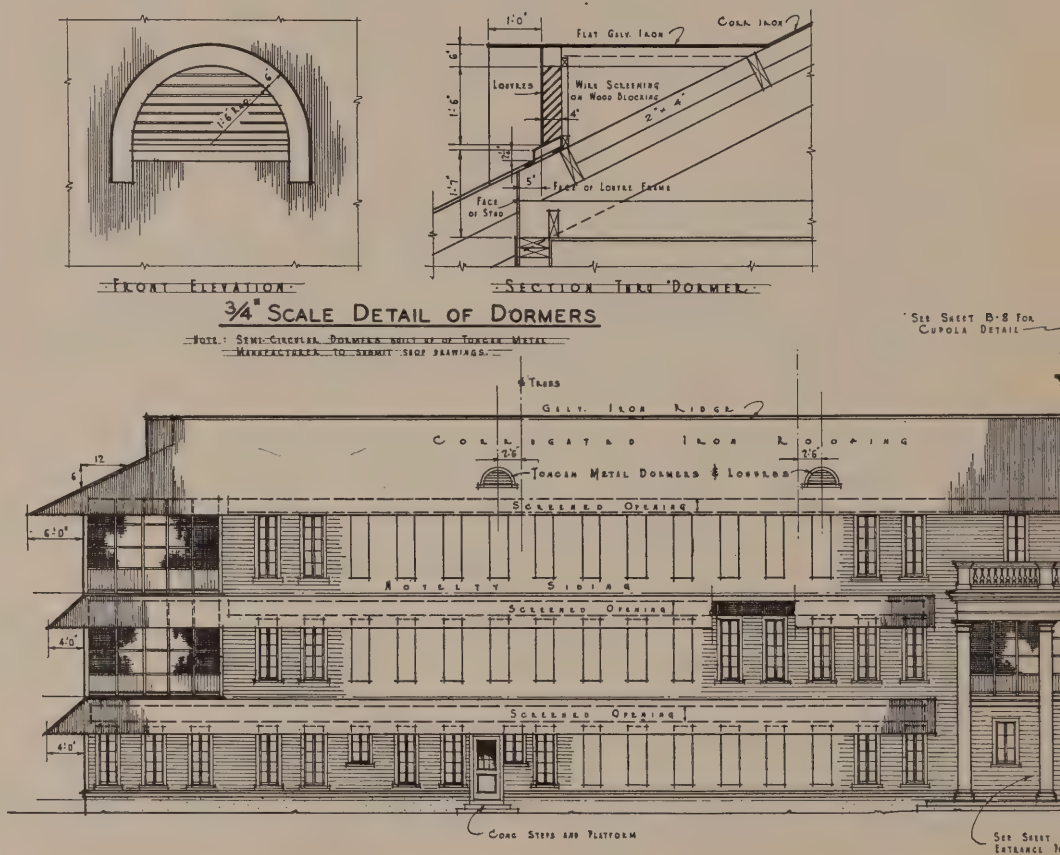
The satisfactory results obtained in freeing carriers by swabbing the throat with mercurochrome is referred to by Dr. Nutter in a special report in the present Annual Report (page 192).

PULMONARY TUBERCULOSIS

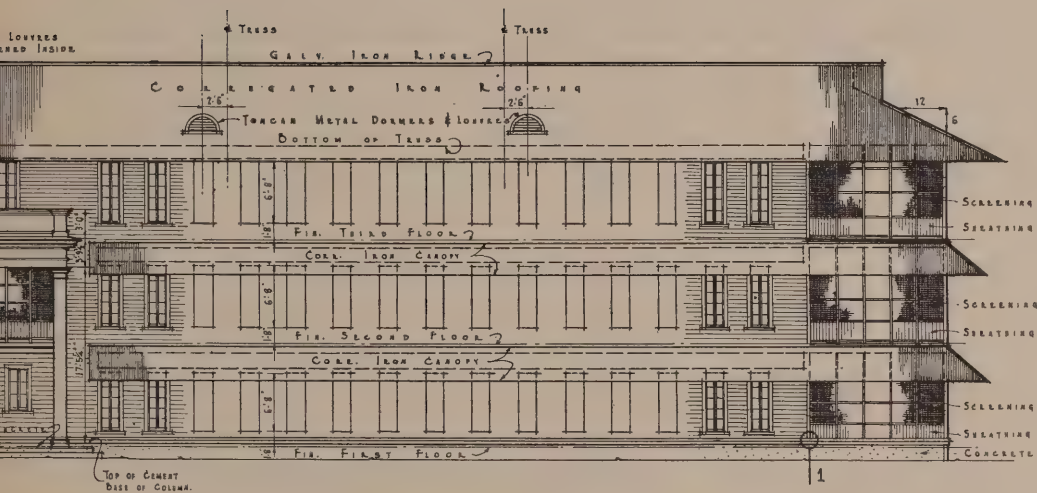
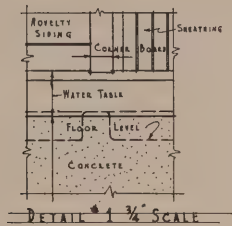
Altogether, 228 cases were treated in the hospitals: and of these, 36 died. Some of the cases that develop tuberculosis, are repatriated or directed to live in colder climates, at higher elevations, where conditions are more favorable for convalescence.

Of the cases, 7 were from temperate zones (3 non-employees); 150 cases developed among the laboring population, and 71 were native non-employees.

In the discussion of lobar pneumonia, reference was made to the low resistance to respiratory infections which is characteristic of the native Indian, negro



THIS SKETCH HAS BEEN REDUCED TO APPROXIMATELY TWO-FIFTHS OF THE SIZE



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PANAMA

CHIRIQUI LAND CO.

ENGINEERING DEPT.

BOSTON MASS.

APPROVED

J. P. Rowe

DRAWN BY J.O.C.J.F.F.

CHECKED BY J.F.F.

CORRECT G.R.S.

SCALE $\frac{1}{8}'' = 1'-0''$

DATE DEC. 26, '28

FILE NO. 3060

SH. NO. A-4

ORIGINAL BLUEPRINTS, AND SCALES SHOWN MUST BE MODIFIED ACCORDINGLY

and mixed races, as evidenced by the complicating conditions. Similar evidence of low resistance is encountered in tubercular affections, and post-mortem findings generally show that the lesions are not confined to the pulmonary tissues, but are disseminated throughout the system.

Several Latin-American countries are making satisfactory provision to take care of these cases. Institutions have been built, or are contemplated, in healthy localities of high altitudes, where the afflicted can receive the benefit of skilled medical attention.

In this connection it may be stated that Dr. Neumann, of the Almirante Hospital, performed two phrenicotomy operations on cases of advanced unilateral pulmonary tuberculosis, and obtained very satisfactory results. One patient rapidly gained 10 pounds in weight, and the sputum became free of tubercle bacilli.

ERYSIPELAS

For many years the routine method of treating erysipelas in the United Fruit Company's hospitals has been to paint the entire inflamed area, and the adjoining healthy skin to the extent of about $\frac{1}{2}$ inch, with pure carbolic acid, and as soon as the surface turns white (in about from 5 to 10 seconds) to freely apply pure alcohol to the painted surface. The results have been exceedingly gratifying. Usually the temperature falls within from 3 to 6 hours, and no further treatment is necessary.

The same method of treatment is followed in cases of herpes zoster. The surface of the skin corresponding with the distribution of the nerve where the lesions are located is treated in the above-mentioned manner. We have never observed a case in which further treatment was necessary, and usually within twenty-four hours the patient can return to duty.

Dr. Neumann, of the Almirante Hospital, has introduced the methylene-blue method of treatment, and Dr. Brosius reports excellent results from it. A child suffering from erysipelas was admitted to the Almirante Hospital with a temperature of 105°. The lesions extended around the entire circumference of the leg from the ankle to the knee. This area was painted beyond the lines of demarkation every 8 hours on 5 occasions with a 5% methylene-blue aqueous solution. The temperature became normal in 44 hours by lysis, and remained so. This case was treated by Dr. Dove.

VENEREAL DISEASES

The venereal-disease menace in the plantations of the United Fruit Company is serious and of growing importance. Our data on its incidence are limited to those cases only that require dispensary or hospital treatments, or to cases in which venereal diseases are encountered as a secondary diagnosis in the treatment of other conditions.

These social diseases are not given the attention they merit in any country,

considering the vast number of individuals who die prematurely or become disabled, mentally or physically, either temporarily or permanently, from their immediate or remote effects.

In some countries comprehensive laws have been enacted with the object of preventing the spread of these diseases, but the laws are rarely enforced and the social leper is generally permitted to run rampant, infecting innocent victims. Within a generation the social-disease menace could be made past history if measures were enforced making these diseases reportable and, under certain conditions, quarantinable, with severe penalties meted out to all who knowingly transmit the infections to others.

With proper treatment over comparatively short periods, in most cases individuals infected with syphilis can be rendered non-infectible and the transmission of this disease correspondingly circumscribed.

The Superintendent of one of the divisions reports that, in 1927, venereal cases required 3,634 days of hospitalization; and in 1928, 5,292 days. Only those cases were hospitalized that were in need of surgical attention, and they were discharged as soon as they could be treated as ambulatory cases. He conservatively estimates that in his division alone the cost of caring for these cases in 1928 was \$10,000.

The close cooperation of the medical profession and civil authorities is necessary if any reasonable measure of control is to be effected.

DHOBIE-ITCH OINTMENT

This preparation was referred to in the Fourteenth Annual Report (1925) of the United Fruit Company's Medical Department, as being extensively used in the treatment of dhobie itch, pruritus ani, and some other parasitic fungi skin infections. The formula there published was:

R		
Acidi. salicylici	grs. xx	4 grams
Hydrargyri. ammoniati	" xx	4 "
Bismuthi. subnitratiss	℥ i	12 "
Olei. eucalypti	℥ i	12 cc.
Adeps lanae (anhydrous) q. s. ad.	℥ i	100 grams

It is recommended that this be changed to read as follows:

R		
Acidi. salicylici	grs. xl	8 grams
Hydrargyri. ammoniati	" xx	4 "
Bismuthi. subnitratiss	℥ i	12 "
Olei. eucalypti	℥ i	12 cc.
Adeps lanae (hydrous) q. s. ad.	℥ i	100 grams

It is further recommended that in the treatment of pruritus ani, the carbohydrate content of the food intake be greatly restricted and that increased quantities of root and green vegetables and fresh fruits be consumed.

W. E. D.

SECTION II

OBSERVATIONS AND EXPERIMENTS IN THE PANAMA DIVISION
OF THE UNITED FRUIT COMPANY, WITH SPECIAL REFERENCE
TO CERTAIN MEASURES FOR THE CONTROL OF MALARIA

December, 1928, to February, 1929

M. A. BARBER, Special Expert, W. H. W. KOMP, Associate Sanitary Engineer,
and B. M. NEWMAN, Scientific Assistant, United States Public Health Service

PART I

THE EFFECT OF SMALL DOSES OF PLASMOCHIN ON THE VIABILITY OF GAMETO-
CYTES OF MALARIA AS MEASURED BY MOSQUITO INFECTION
EXPERIMENTS

Investigators have generally agreed that plasmochin has a selective action on the gametocytes of malaria. On crescents especially, the destructive action of plasmochin has proved to be decidedly more effective than that of any other drug. The result of plasmochin treatment has usually been measured by the time required to free the peripheral blood from crescents. The object of the present work has been to determine, by mosquito-feeding experiments, the effect of small doses of plasmochin on the viability of gametocytes. Our cases with one or two exceptions have had to do with crescent-carriers.

We began this work in Feb. 1928.¹ We have summarized the experiments of that year and included them in this paper, in order to bring all the material together.

In all experiments we used *A. albimanus* as the test mosquito because of its susceptibility to malaria parasites and its eagerness to bite man. In all of the experiments of 1929 we used only mosquitoes bred in the laboratory. In two cases of 1928 all or part of the mosquitoes were caught in the adult stage. All proved to be negative, so that no error was introduced through infections contracted previous to use in these experiments.

We fed mosquitoes only once on a given carrier, and dissected only mosquitoes known to have taken blood. In the records we included only dissections made approximately 3 days after feeding, in order to allow sufficient time for the growth of oöcysts easily discernible under the microscope. We often used the oil-immersion lens for the examination of mid-guts on which oöcysts were likely to be small.

The mosquitoes were kept at the room temperature obtaining in the Tropics at sea level. We kept a daily record of the temperature of the compartment containing the mosquito cages. This temperature varied from a minimum of

66 F. at 8 A.M. to 85 F. at mid-day; but nearly all of the readings fell between 70 and 83 F.

CASE NO. 1

Subject: M. J.

Entered Hospital Jan. 3, 1929 at 1:00 P.M.

Race: White (Costa Rican)

Diagnosis: E. A. Malaria. Case No. 24,082.

Age: 24. Weight, 104 Lbs., or 47.2 Kg.

Date 1929	Day	Treatment			Hour Mosquitoes Fed	Crescents per 1,000 Leu- kocytes	Results of Mosquito Dissections			
		Plasmo- chin	Quinine Sulphate	When Given			Number Dissected	Number Positive	Per Cent Mosqui- toes Infected	Average Number Oöcysts per Pos- itive Gut
Jan. 3	1	None	10 grains (65 cg.)		—	—				
Jan. 4	2	None	30 grains (195 cg.)		—	—				
Jan. 5	3	2 cg. 2 cg.	13 $\frac{3}{4}$ grains (86 cg.) 8 $\frac{3}{4}$ grains (56 cg.)	8:30 A.M. 5:00 P.M.	10:00 A.M.	97	5	5	100.0%	16
Jan. 6	4	None	10 grains (65 cg.) 10 grains (65 cg.) 10 grains (65 cg.)	8:30 A.M. 12 M. 5:00 P.M.	10:30 A.M.	100	17	0	0.0	0
Jan. 7	5	None	10 grains (65 cg.) 10 grains (65 cg.) 10 grains (65 cg.)	8:30 A.M. 12 M. 5:00 P.M.	9:00 A.M.	51	16	0	0.0	0
Jan. 8	6	None	10 grains (65 cg.)	8:30 A.M.	8:30 A.M.	11	13	0	0.0	0

NOTE 1. The total amount of plasmochin, 4 cg., given on Jan. 5 is at the rate of 1.69 milligrams per kilogram of body weight.

NOTE 2. On Nov. 27, 1928, same patient was admitted to the hospital with estivo-autumnal malaria (Case No. 23,892). He received 2 plasmochin compound tablets, b.i.d., for 12 days, a total of 48 cg. plasmochin and 90 grains quinine sulphate, and was discharged with negative blood.

The gametocytes were counted in the blood films taken at the time of the mosquito feedings. We usually estimated the number of gametocytes in terms of the number per 1,000 leukocytes, and in all crescent cases at least 1,000 leuko-

cytes were counted. Of course, we appreciate the error in measuring one variable by another; but our object was merely to get comparative readings, and it was unlikely that the leukocyte count of a patient varied materially during a given experiment. In some cases we also determined the number of gametocytes per cubic millimeter of blood.

In all of the 1929 series the doses of plasmochin or quinine were administered by ourselves or in the Company hospital under medical supervision. Some exceptions in the 1928 series are noted in the text.

CASE No. 2

Subject: D. C.

Race: Mixed Negro and Spanish Panamanian

Age: 3. Weight, 38½ Lbs., or 17.5 Kg.

Outpatient, Discovered in Chiriquito Malaria Survey

Diagnosis: E.A. Malaria

Date 1929	Day	Treatment			Hour Mosquitoes Fed	Crescents per 1,000 Leu- kocytes	Crescents per Cubic Milli- meter of Blood	Results of Mosquito Dissections			
		Plasmo- chin	Quinine Sulphate	When Given				Number Dissected	Number Positive	Per Cent Mosqui- toes Positive	Average Number Oöcysts per Pos- itive Gut
Feb. 9	1	None	None	—	6:30 P.M.	55	—	6	1	16.6%	3
Feb. 10	2	None	5 grains (32.5 cg.)	9:30 P.M.	7:30 P.M.	48	—	17	11	64.7%	3.5
Feb. 11	3	None	5 grains (32.5 cg.)	8:00 A.M.			—				
			5 grains (32.5 cg.)	4:00 P.M.	7:30 P.M.	55		6	4	66.6%	4
Feb. 12	4	1.5 cg.	5 grains (32.5 cg.)	8:00 A.M.	7:30 P.M.	36	—	16	0	0.0%	—
Feb. 13	5	None	5 grains (32.5 cg.)	A.M.	6:30 P.M.	24	192	17	0	0.0%	—
			5 grains (32.5 cg.)	P.M.							
Feb. 14	6	None	5 grains (32.5 cg.)	A.M.	7:00 P.M.	3	—	16	0	0.0%	—
			5 grains (32.5 cg.)	P.M.							
Feb. 15	7	None	5 grains (32.5 cg.) 5 grains (32.5 cg.)	A.M.	7:00 P.M.	2	—	8	0	0.0%	—

NOTE: The single dose of plasmochin given on Feb. 12 equals 0.859 milligrams per kilogram of body weight.

Comments on Case No. 1.—Two days' treatment with quinine, totalling 40 grains, or 260 cg., had no appreciable effect on mosquito infection; all of the 5 *albimanus* fed on the carrier became infected. But 24½ hours after the first dose of plasmochin and 17½ hours after the second no infections occurred, although the number of crescents had remained constant or had slightly increased. We obtained no infections during two more daily feedings, making in all three negative feedings, in every case with considerable numbers of mosquitoes and a fairly high percentage of gametocytes.

Crescents in thin films taken from the patient at the time of the second feeding, Jan. 6, and kept moist, and in thick films, assumed the rounded form characteristic of living gametocytes. No rings were present after Jan. 5.

Comments on Case No. 2.—Three feedings on three successive days before plasmochin treatment gave an increasing percentage of positive mid-guts; but only 11½ hours after the first dose of plasmochin (1.5 cg.) mosquitoes became negative and remained so during three successive days, no further plasmochin being administered. The numbers of crescents diminished somewhat, but on Feb. 13 they were still present at the rate of 192 per cubic millimeter of blood.

We made a careful comparison in thin films of the morphology of crescents taken on Feb. 9 before any sort of treatment had been given, with that found after treatment with plasmochin; the post-plasmochin specimens included films taken on Feb. 12, when crescents first failed to infect mosquitoes, and those taken on Feb. 13, 34½ hours after the plasmochin dose. In the comparison we looked for any evidences of degeneration: faintness of staining, irregularity in the outline of crescents, vacuolization of the cytoplasm, granulation of the chromatin or displacement of the pigment. Changes, apparently degenerative, appeared in the post-plasmochin crescents; but these could be matched by similar changes in the crescents taken before any treatment. We detected only one measurable difference: In the post-plasmochin films a slightly larger percentage of crescents exhibited fainter staining than in the control. These comparisons were made by two observers working independently—in one set, the observer was not informed as to the source of the films he was examining until after he had made his notes.

The proportion of sexes among gametocytes taken before and after plasmochin varied little, if at all, and we could see no evidence that one sex had been affected by plasmochin more than the other. Crescents in the shed blood assumed rounded forms after plasmochin dosage, as well as before it; and in this patient, as in Case No. 1, it was evident that at least a part of the crescents were living at a time when they failed to infect mosquitoes.

Comments on Case No. 3.—No mosquitoes became infected in feedings made about 24 hours after a single dose of ½ cg. plasmochin, although the number of crescents had materially increased. We observed exflagellation of male crescents with the formation of microgametes in blood taken on the day after plasmochin treatment. The blood was taken from mosquitoes which had engorged themselves on the carrier. Within a few minutes after feeding, the

CASE No. 3

Subject: A. H. Hospital Patient
 Race: West Indian Negro Diagnosis: E.A. Malaria
 Age: 11. Weight, 59 Lbs., or 26.9 Kg.

Date 1929	Day	Treatment			Hour Mosquitoes Fed	Crescents per 1,000 Leu- kocytes	Crescents per Cubic Milli- meter of Blood	Results of Mosquito Dissections			
		Plasmo- chin	Quinine Sul- phate	When Given				Number Dissected	Number Positive	Per Cent Mosqui- toes Infected	Average Number Oocysts per Pos- itive Gut
Feb. 26	1	0.5 cg.	None	1:30 P.M.	1:15 P.M.	26	130	14	4	28.6%	10
Feb. 27	2	None	None	—	12:30 P.M.	37	—	13	0	0.0	—

NOTE 1. The single dose of one-half centigram of plasmochin given on Feb. 26 is at the rate of 0.185 milligrams per kilogram of body weight.

CASE No. 4

Subject: M. S. Outpatient, Discovered in One-Mile Camp Survey
 Race: West Indian Negress Diagnosis: E.A. Malaria
 Age: 3

Date 1928	Day	Treatment			Hour Mos- quitoes Fed	Crescents per 1,000 Leu- kocytes	Crescents per Cubic Milli- meter of Blood	Results of Mosquito Dissections			
		Plasmo- chin	Quinine Sulphate	When Given				Number Dissected	Number Positive	Per Cent Mosqui- toes Positive	Average Number Oocysts per Pos- itive Gut
Feb. 13	1	3 cg.	10 grains (65 cg.)	P.M.	A.M.	196	—	14	10	71.4%	19
Feb. 14	2	3 cg.	10 grains (65 cg.)	P.M.	—	—	—	—	—	—	—
Feb. 15	3	—	—	—	A.M.	90	756	16*	0	0.0%	—

NOTE 1. Exact body weight unknown, but estimated at about 50 pounds. Thus the dosage would approximate 1 milligram per kilogram of body weight. (50 lbs. equals approx. 22.6 kg.)

NOTE 2. First examination of blood made on Jan. 12, 1928; a few estivo-autumnal rings were found, but no crescents. Patient was treated with plasmochin-quinine, and blood was found negative on Jan. 22. On Feb. 13, relapsed with many estivo-autumnal rings and 196 crescents per 1,000 leucocytes in blood.

* Of these mosquitoes, 4 were caught in the adult stage. The rest were laboratory-bred.

blood was removed from the mosquitoes, spread thinly on a slide and stained with Giemsa. Exflagellation was demonstrated by this method in blood taken at two different times during the day: the first, 24 hours after the plasmochin dose, a time when subsequent dissections indicated that the gametocytes had lost their power of infecting mosquitoes, and the second, about 2½ hours later.

This carrier (Case No. 3) was obtained at the very end of our 1929 tour, and it was impossible to conduct further feedings on him.

Experiments connected with Cases Nos. 4 and 5 were done in 1928 (l.c.).

Comments on Case No. 4.—Crescents had decreased after the plasmochin treatment but were still present in large numbers (756 per cu. mm. of blood). They had apparently become non-viable. Estivo-autumnal rings persisted in large numbers.

CASE No. 5

Subject: B. C.

Outpatient, Discovered in Malaria Survey

Race: West Indian Negress

Diagnosis: Estivo-autumnal Malaria

Age: 14 years (Weight Unknown)

Date 1928	Day	Treatment			Hour Mosquitoes Fed	Crescents per 1,000 Leu- kocytes	Results of Mosquito Dissections			
		Plasmo- chin	Quinine Sulphate	When Given			Number Dissected	Number Positive	Per cent Mosqui- toes Infected	Average Number Oocysts per Pos- itive Gut
Jan. 30	1	6 cg.	11.5 gr. (75 cg.)	3 P.M.	1 P.M.	26	13	10	77.0%	8
Jan. 31	2	6 cg.	11.5 gr. (75 cg.)	?	—	—	—	—	—	—
Feb. 1	3	None	None	—	?	8	6	0	0.0%	0

Comments on Case No. 5.—Crescents had greatly diminished after plasmochin treatment and no longer infected mosquitoes.

In cases 4 and 5 one dose of plasmochin plus quinine was administered to the patient at the hospital, and the rest given to him or his parents for him to take at home.

Two other cases of 1928 may be mentioned. In these we were unable to make any mosquito test before the administration of plasmochin, and do not know surely that their gametocytes were viable before treatment. In one case the patient had received one day's treatment, consisting of 6 cg. plasmochin and 175 cg. quinine, when the mosquitoes were fed. He still had about 100 benign tertian gametocytes per 1,000 leukocytes; the gametocytes showed some modification as the result of the treatment. None of the 11 mosquitoes fed on this patient became infected. In the second case the patient had received one day's

treatment, consisting of 2 cg. of plasmochin and 58 cg. of quinine, and still had 26 crescents per 1,000 leukocytes in the blood. Seven mosquitoes caught in the adult stage were fed on this patient, and none of them became infected. In both of these cases the species of mosquito was *A. albimanus*.

Summary of cases.—The results of these experiments seem to be clean-cut. In no case did mosquitoes become infected after plasmochin treatment. It appears that single doses as small as 0.2 mg. per kg. of body weight may affect the viability of crescents, even though they have increased in numbers, and are still living and capable of exflagellation. Quinine alone showed no measurable effect on the viability of crescents during the period of time covered by the preliminary feedings.

TABLE I

LIST OF APPARENTLY GOOD CARRIERS FOUND IN MALARIA SURVEYS OF PANAMA DIVISION, 1929

Check No.	Type of Gametocyte	Numbers of Gametocytes	Result
1.	Estivo-autumnal	94 crescents per 1,000 leukocytes	Infected 5 <i>A. albimanus</i>
2.	Tertian	33 gametocytes per 1,000 leukocytes	Failed to infect
3.	Estivo-autumnal	14 crescents per 1,000 leukocytes	Failed to infect
4.	Estivo-autumnal	11 crescents per 1,000 leukocytes	Failed to infect
5.	Estivo-autumnal	3 crescents per field	Unavailable until after gametes reduced
6.	Estivo-autumnal	6 crescents per 1,000 leukocytes	Unavailable
7.	Quartan	15 gametocytes per 1,000 leukocytes	Failed to infect
8.	Estivo-autumnal	16 crescents per 1,000 leukocytes	Failed to infect
9.	Estivo-autumnal	55 crescents per 1,000 leukocytes	Infected 16 <i>A. albimanus</i>
10.	Estivo-autumnal	103 crescents per 1,000 leukocytes	Unavailable
11.	Estivo-autumnal	43 crescents per 1,000 leukocytes	Unavailable
12.	Estivo-autumnal	26 crescents per 1,000 leukocytes	Infected 4 <i>A. albimanus</i>

425 positives found in surveys; 12 apparently good gametocyte-carriers discovered, of which 8 were available. Only 3 of these infected mosquitoes.

We appreciate the fact that our cases are comparatively few. The conditions of our experiments demanded that the patient have sufficient gametocytes in the blood to infect mosquitoes at a single feeding, and we had much difficulty during our tour in 1929 in getting enough patients suitable for our experiments. In our search for carriers, we made many blood parasite surveys on the farms of the Panama Division and elsewhere. One or two groups were treated with quinine alone in small doses in the hope that they might develop more abundant crescents. In all, we examined over 1,500 blood specimens and found over 400 with parasites in the peripheral blood. Among these positives we found a considerable number with very few gametocytes, but only 12 with sufficiently

heavy infections to afford good "prospects." The situation was made more difficult by the fact that it was necessary to test the infectibility of the gametocytes by mosquito feedings, and we sometimes wasted several days' time before we knew that the patient was not suitable. In five cases the preliminary feedings gave negative results and the cases could not be used.

CASE A

Subject: B. S. Entered Hospital Jan. 14, 1929, at 1:00 P.M.
 Race: White (Costa Rican) Diagnosis: Tertian Malaria
 Age: 22. Weight 106½ Lbs., or 48.3 Kg.

Date 1929	Day	Treatment			Hour Mosquitoes Fed	Gametocytes per 1,000 Leu- kocytes	Results of Mosquito Dissections		
		Plasmo- chin	Quinine Sulphate	When Given			Number Dissected	Number Positive	Per Cent Mosqui- toes Positive
Jan. 14	1	None	10 grains (65 cg.)	3:30 P.M.	3:15 P.M.	33	25	0	0
		4 cg.	17.5 gr. (113 cg.)	10 P.M.					
Jan. 15	2	None	20 grains (130 cg.)	8 A.M.	5:15 P.M.	100	34	0	0
		4 cg.	7.5 gr. (48 cg.)	4 P.M.					
Jan. 16	3	None	10 grains (65 cg.)	8 A.M.	5:00 P.M.	47	4	0	0
			10 grains (65 cg.)	12 M.					
			10 grains (65 cg.)	4 P.M.					
Jan. 17	4	None	10 grains (65 cg.)	8 A.M.	5:30 P.M.	?	4	0	0
			10 grains (65 cg.)	12 M.					
			10 grains (65 cg.)	4 P.M.					

NOTE: On Jan. 8, 1929, six days before this patient entered the hospital, he was found positive for malaria. At this time, no gametocytes or large plasmodia were found in his blood.

Nearly all of the people examined were West Indian Negroes, who often carry large numbers of parasites without showing severe symptoms of malaria. It is possible that another race of people more susceptible to the effects of malaria parasites would have afforded a larger percentage of heavier gametocyte carriers.

Sinton² believes that the stimulus which induces crescent production is much more marked at the time of an acute attack of the disease than in the period when an immunity has been produced.

The list of the 12 more promising carriers with the type and number of gametocytes is given in Table I. The cases marked "unavailable" lived at considerable distances from the hospital and could not be brought to the laboratory in time for the experiments.

In order to illustrate the amount of work which may be lost on an unsuitable carrier, we give in detail the experiments made on a benign tertian carrier, Case A. This case had become infected or had relapsed but recently, and it is possible that the gametocytes had not become sufficiently mature to infect mosquitoes. Gametocytes appeared in considerable numbers, and both sexes were present in the blood at the time of the feeding experiments. They showed definite signs of degeneration after treatment with plasmochin.

THE LENGTH OF TIME GAMETOCYTES MAY BE EXPECTED TO REMAIN NON-VIABLE AFTER A SINGLE DOSE OF PLASMOCHIN

A priori it would not seem probable that the effect of a single small dose would last a long time if new gametocytes are being produced continually in the spleen, bone marrow or elsewhere; and authors generally hold that it is necessary to rid the blood of rings if gametocyte production is to be arrested. In Cases 1 and 2 of our experiments, however, crescents, although present, apparently remained non-viable for three days after plasmochin treatment. In Case No. 2, rings persisted in the peripheral blood throughout the whole period covered by the experiment. In Case No. 3, crescents increased during treatment, although no rings were present in the peripheral blood. In routine blood work we find many cases in which large numbers of rings persist in the blood, although crescents may be lacking or very few. The relation of rings in the peripheral blood to the production of viable crescents is not very definitely known. At all events, it seems probable that a single dose of plasmochin may be effective on crescents during several days at least, whatever the fate of the rings.

Fischer³ states that a plasmochin treatment (in his series 15 or 20 cg.) is just as effective in ridding the patient of gametocytes when given in divided doses over 24 to 36 hours as when the same total dosage is spread over several days.

As regards the value of single doses, much depends, of course, on the length of time an untreated carrier usually carries effective numbers of gametocytes. It has been our observation that in a large proportion of cases such infestations tend to run out within a few days. There are exceptions to this rule, of course, but it would seem that in a majority of cases one or two doses of plasmochin given during the infestation would at least materially shorten the period during which the patients carry viable gametocytes.

As might be expected, gametocytes in patients who have relapsed several

weeks after a plasmochin treatment are just as infective as those occurring during primary attacks. Of our cases, No. 1 had received a plasmochin treatment about a month previously and another, No. 4, about three weeks. Both of these relapsed cases readily infected mosquitoes.

The mosquito test necessitates keeping on hand an abundance of mosquitoes ready for biting; and the subsequent care of the mosquitoes, the dissections and the like, require a good deal of time. It would be an advantage if the effect of small doses of plasmochin could be measured by degeneration or other morphological change in the gametocytes discernible by simple microscopic examination.

A number of authors have noted degenerative changes in gametocytes as the results of plasmochin. Roehl⁴ mentions the destructive effect of the drug on the gametocytes of bird malaria. In human malaria Schulemann and Memmi⁵ and Manson-Bahr⁶ have described degenerative changes in benign tertian gametocytes. We (*l.c.*, p. 61) noted a marked modification in such gametocytes after 6 cg. of plasmochin and 175 cg. of quinine.

Schulemann and Memmi (*l.c.*) state that crescents before their disappearance under plasmochin treatment are more difficult to stain. Manson-Bahr (*l.c.*) describes degenerative changes in the crescents in several cases treated with plasmochin-compound. In one case, after a total dosage of 12 cg. of plasmochin and 1.5 cg. of quinine, the crescents in dying underwent a peculiar granular degeneration. In another case, after a dosage of 3 cg. of plasmochin plus 0.375 gm. quinine, the gametocytes became inert; that is, the majority of them no longer became spherical on being chilled outside of the body, and exflagellation did not occur in any of them. Within 36 hours after the commencement of the treatment (8 cg. plasmochin and 1 gm. quinine), crescents assumed distorted forms, their protoplasm underwent a granular degeneration, and their chromatin was broken into small clumps. Mollow⁷ treated a crescent carrier with 5 x 2 cg. pure plasmochin daily. On the fourth day of treatment he noted degenerative changes in the crescents: pale and irregular staining and vacuolization of the cytoplasm. Finally the crescents became completely degenerated. Apparently the male gametocytes were more susceptible to the action of the drug than the female. Muffel⁸ noted, 48 hours after a daily treatment of 6 cg. of plasmochin, that the protoplasm of the crescents became vacuolated and their outline became irregular. The earlier morphological changes appeared before any diminution in the number of the crescents had occurred. Later, degeneration became more advanced; only the pigment with bare traces of protoplasm remained. The action of plasmochin did not appear in all crescents at the same time nor with like distinctness.

Krauss⁹ found that senile changes, including vacuolization, which occasionally occur in gametocytes independently of any treatment, may become the rule after plasmochin.

We have already noted that in our experiments the crescents, or a part of

them, were still living after plasmochin treatment and showed no degenerative changes sufficiently definite to serve as a useful criterion of viability. However marked the degenerative changes in crescents after larger dosage or more prolonged treatment, it appears that we can not rely on the microscope alone to measure the early effects of very small doses of plasmochin, and the mosquito infection test appears to be the only one of sufficient delicacy to serve that purpose. Possibly wet fixation of films or some more precise staining method might afford evidences of degeneration not exhibited by thin and thick films prepared in the ordinary manner.

THE USE OF PLASMOCHIN AS A GAMETOCIDE IN POPULATIONS

Authors generally hold that treatment with plasmochin is not safe except under immediate medical supervision, because of occasional harmful by-effects of the drug. Mühlens¹⁰ has recommended as a safe dose one not exceeding 1 mg. per kg. of body weight. Such a dose would amount to about 6 or 7 cg. for a person weighing 150 lbs. Fischer (*l.c.*) holds that a dose of 15 or 20 cg. distributed over 36 hours is sufficient to destroy gametocytes, and lies within the limits of safety. Baermann and Smits¹¹ have summarized the literature of the 4 fatal cases and the 11 very severe cases supposedly due to the by-effects of plasmochin. In all of these the total amount of plasmochin given varied between 16 and 40 cg. The authors believe that the dosage recommended by Mühlens is not wholly safe.

Macphail¹² has extended plasmochin treatment to camp work. A daily dose of 6 cg. plasmochin and 20 grains of quinine was given under the supervision of dispensers. Dr. Brosius, of the Panama Division, has also demonstrated that plasmochin, combined with quinine and employed in limited dosage, may be safely distributed in a population and taken without the immediate supervision of a physician.

Our experiments indicate that a dosage far below that recommended by Mühlens or Fischer or that used in the camp treatments of the United Fruit Company is effective against gametocytes, and it is very probable that such small doses can be safely used in any population. It is well to employ caution, of course, but it would at least seem advisable to employ plasmochin for mass treatment of a group suffering severely from malaria, especially where transmission is active. The risk of by-effects of plasmochin would be outbalanced by the malaria danger.

It is presumed that plasmochin would be used in conjunction with quinine, at all events in regions where estivo-autumnal malaria is prevalent; for plasmochin alone is not sufficiently effective against the asexual forms of estivo-autumnal parasites, and good evidence exists that quinine tends to counteract the harmful effects of plasmochin.

It is evident that any drug used to prevent the transmission of malaria must be widely used in a population. In many regions comparatively few persons

sick with malaria ever receive the care of a physician in hospitals or elsewhere. Among negroes parasitic infestations may not be followed by serious illness, and patients are not likely to receive medical aid.

In plantations or other localities where populations can be assembled and treated *en masse*, the employment of plasmochin is comparatively easy. In populations not under such control the problem becomes much more difficult. People are not apt to take any remedy for purely public-health purposes.

In some regions people are accustomed to take chill tonics for malaria. It is at least worth considering whether a tonic containing sufficient quinine and a very small percentage of plasmochin might not be practical. It is yet to be proved just how little plasmochin would suffice to render gametocytes non-viable if taken in this form. Further, it would be necessary to guard against a possible cumulative effect of the drug. But tonic-takers usually discontinue treatment after a few doses, especially if the "fever is broken," and the risk might not be materially greater than it is in a variety of popular remedies where overdose is dangerous and caution must be enjoined.

In conclusion, our experiments indicate that amounts of plasmochin within the limits of safety are effective against gametocytes and may be combined with quinine (and caution) in the treatment of populations. Where plasmochin is now being used for this purpose it is probable that smaller amounts of the drug can be used without diminishing the gametocidal effects of treatments and with a gain in economy and safety.

SUMMARY

1. Plasmochin in small doses, in one case in a single dose of $\frac{1}{2}$ cg., proved to have a definite effect on the viability of crescents as measured by mosquito infection tests.

2. Degenerative changes in crescents after the use of plasmochin did not appear to be definite enough to measure the early effects of small doses of plasmochin.

3. It is probable that the general use in a population of such small doses of plasmochin would be safe and effective in reducing the transmission of malaria.

Acknowledgement: We are indebted to Dr. O. T. Brosius, Superintendent of the Medical Department, Panama Division, and to his staff for generous assistance in this work.

PART II

MALARIA-PARASITE SURVEYS

We made malaria-parasite surveys of many camps of the Panama Division during our second tour there, December, 1928 – February, 1929. These examinations we undertook for the purpose of securing gametocyte-carriers suit-

able for plasmochin experiments, and of comparing the rates we obtained during our first tour, January-February, 1928, with those found a year later. We used thick-films, and examined all the preparations ourselves.

Table 1 (see below) shows the malaria parasite rates of camps surveyed in 1929 only, and Table 2 (page 47) compares the rates in camps surveyed in both years. Table 2 also includes a comparison of rates obtained in certain localities situated outside of Company territory. These tables include only examinations made before any recent mass treatments had been given.

It will be noted in Table 2 that the total rate of 1929 is considerably higher than that of 1928. The total increase is largely due to increases in two camps, Margarita and Chiriquicito. The rate of children 12 years and under increased in about the same ratio as that of the total population.

TABLE 1
COMPANY CAMPS SURVEYED IN 1929 ONLY, PANAMA DIVISION

Locality	No. Exd.	No. Positive	Per Cent Positive
San-San	68	11	16.1
Farm Ten	57	11	19.3
Daytonia	60	9	15.0
Zavala	13	1	7.7
Farm Four	75	10	13.3
Farms One, Five and Six	109	18	16.5
Olivia	33	7	21.2
Farms Two and Three	86	21	24.4
Elena	59	14	23.7
Chase	50	18	36.0
Half-Mile Camp	51	7	13.7
Totals	661	127	19.2

Among 407 positive specimens, which include some examinations not appearing in the tables, we found the following percentage incidence of type of parasite: Estivo-autumnal, 82.3; benign tertian, 10.8; quartan, 6.8. In the same group of positives, 28.0 per cent showed heavier infections; that is, at the rate of one or more parasites per thick-film field.

We resurveyed one camp, Margarita, after an interval of 19 days. The results give some idea of the proportion of parasite-carriers which may be missed in a single survey. In the second survey, positives appeared among persons previously negative in about the same proportion as among those previously positive (39 per cent and 43 per cent, respectively). The reexamination raised the percentage positive of the camp from 46.6 to 61.3 although only 70 per cent of those negative in the first examination appeared for reexamination. Such results show the inadequacy of a single survey as a basis for the treatment of a group. Where a single survey gives a rate as high as 46 per cent, as it did in this camp, it may be fairly presumed that all or nearly all of the population is infected.

Guabito White School, Table 2, gave only one positive in 1928. In 1929, the single positive found proved to be the same Indian youth who was positive the year before. Only 11 children appeared in 1929 for examination. The general malaria-parasite rate of native children in Guabito is high. The children of Guabito White School live in screened houses and undoubtedly receive better care generally than do their neighbors.

A note on the technique of thick-film blood examinations may not be out of place. We have observed that in some laboratories batches of slides are allowed

TABLE 2

COMPARISON OF COMPANY CAMPS SURVEYED IN 1928 AND IN 1929, PANAMA DIVISION

Locality (All Ages)	1928			1929		
	No. Exd.	No. Pos.	% Pos.	No. Exd.	No. Pos.	% Pos.
One-Mile	407	35	8.6	62	10	16.1
Dos Canos	103	42	40.8	56	22	39.3
Base-Line	143	32	22.3	89	16	18.0
Base-Line School	65	17	26.1	49	13	26.5
Feilds'	40	12	30.0	53	14	26.4
Margarita	33	7	21.2	75	35	46.6
Chiriquicito	33	18	54.5	80	56	70.0
Guabito	185	50	27.0	100	18	18.0
Guabito White School	20	1	5.0	11	1	9.1
Totals	1,029	214	20.8%	575	185	32.2%
Children's Rate	450	107	23.7%	261	91	34.8%

COMPARISON OF CERTAIN OUTSIDE LOCALITIES, 1928 AND 1929

	1928			1929		
	No. Exd.	No. Pos.	% Pos.	No. Exd.	No. Pos.	% Pos.
Bocas del Toro (School Children) . . .	148	54	36.5	121	41	33.9%
Careening Cay (School Children) . . .	47	23	48.9	30	8	26.6%
Totals	195	77	39.4%	151	49	32.4%

to dry too much before staining. The thick films kept overnight usually will not come loose from the slide and will stain well. But if they be kept too long in an incubator or, when unprotected from desiccation, at the room temperatures obtaining in hot dry weather, the red cells will not lake out well and parasites do not stain sharply in Giemsa. Unless the examiner is on his guard he may obtain lower parasite rates in a hot, dry season than the real condition of things warrants.

PART III

SOME OBSERVATIONS ON THE BREEDING PLACES OF ANOPHELES ALBIMANUS
THE USE OF THE ADULT-ANOPHELINE INDEX IN DETERMINING THE
RESULTS OF ANTILARVAL MEASURES

We made many mosquito surveys in the Panama Division during our first tour there, January and February, 1928, and during our second tour, December, 1928-February, 1929. It happened that the weather was rainy up to the middle of February, 1928, while the corresponding period in 1929 was very dry. This variety in weather occasioned many changes in the number and character of waters favorable for anopheline breeding. It appeared that *A. albimanus* (the chief malaria-carrier of this region) is capable of adapting itself to a greater variety of breeding place than is generally recognized.

We took as a test locality a certain private farm provided with a large pasture, ditches, banana fields, streams and jungle.

During the wet period, depressions in the ground hardly deeper than a soup plate were kept full of water and favorable for breeding. This condition extended over one month, a period more than twice as long as that necessary to harbor *Anopheles* from egg to maturity. We found larvae of *albimanus* plentiful in the pasture, breeding in grassy depressions, ditches, pools and animal tracks; and large numbers of adult *albimanus* in a house on the farm.

During the 1929 tour, the pasture dried almost completely, but considerable numbers of *albimanus* still bred in ditches situated in the open and in those draining banana fields. We also found smaller numbers in a clear stream associated with the anopheline, *Chagasia bathanuss* Dyar.

The preferred breeding places of *albimanus* are collections of fresh or brackish water open to the sun and not too much fouled by decaying vegetation. It appeared from our surveys that this species, in dry weather at least, may adapt itself to deep ditches or even clear streams. In these places the number of larvae may be small, but where such waters occur in abundance they must be reckoned with.

It is obviously impracticable to do larvicidal work in a wide territory of jungle surrounding a camp. The policy of the United Fruit Company has rightly been to confine larvicidal work to the immediate vicinity of groups of habitations, including in some cases more distant breeding places so limited in extent as to be manageable.

Whatever the territory covered, it is important, in view of the adaptability of *albimanus*, to determine the effect on the adult anopheline density of such larvicidal work as is attempted. The best single test is afforded by a census of mosquitoes found in dwellings or in resting places near them.

We made such censuses in a number of camps situated in Company territory during the wet and dry periods of 1928 and 1929. A few examples of such sur-

veys may illustrate the advantage of keeping a close account of the results of anti-mosquito work:

Margarita, Panama Division.—In February, 1929, we found large numbers of *albimanus* in the houses of plantation laborers. The malaria parasite rate was very high, 46.6%. Pastures and ravines near the camp, which might produce considerable numbers of *Anopheles* in rainy weather, had nearly dried up. But breeding was abundant in a large lagoon situated about 300 meters from the camp, and in an ancient bed of the Sixaola River about one mile distant. It would be of doubtful utility to spend money on merely local larvicidal work in this camp, if the more distant places were neglected.

Base Line, Panama Division.—In 1928 during wet weather we found *albimanus* breeding in animal tracks and elsewhere close to a farm house. During the dry weather of 1929, breeding in the immediate vicinity of this house was confined to a ditch draining a large pasture; but adult *albimanus* were plentiful in the houses of farm laborers. Within 200 meters of this camp a large lagoon is situated in which *albimanus* breeding was abundant in 1929 and might be expected to be prolific in wet weather also. In this camp it would be useless to continue local larvicidal work without taking into consideration the larger breeding place within easy flight range. Should mosquito control of the lagoon prove impracticable it would be best to depend on some anti-malaria measure other than larvicides.

In two localities, Puerto Arturo, Tela Division, and Toro Spur, Limon Division, we found abundant *albimanus* in farm dwellings at a time when adjacent pastures were wet. We found almost none after these local breeding places had dried up. In such camps local larvicidal work might prove very useful; but here as in all cases a mosquito census taken after the pastures had been treated with larvicides would be necessary, in order to determine whether, after all, the mosquitoes might not be coming from some more distant source which dried up when the pastures did.

The effective flight range of *albimanus* is a matter of much importance. Authors have observed very long flight of various species of *Anopheles*, in some cases several miles. What concerns our problem most nearly is whether worth-while reduction in malaria can be attained by antilarval work within a reasonable distance and expense. The observations we made at Margarita and certain other localities in the Panama Division, where breeding places are distant but the anopheline and malaria rates high, would indicate that we have to reckon with any large breeding places situated within 1/3 mile at least. Such breeding places must be attended to, if effective larvicidal work is attempted at all.

Another phase of the matter is illustrated by the town of Bocas and the neighboring island of Careening Cay. We found a high rate of malaria in both localities in 1928 and again in 1929. The bulk of *albimanus* production of that vicinity is found in Careening Cay, where a brackish swamp immediately adjoins the village. Probably some of the mosquitoes flying over the quarter-mile

or so of land and sea to Bocas are already infected with malaria. Here local ills have wings.

Most of the camps of the United Fruit Company are more widely separated than Bocas and Careening Cay, but in a region like Guabito, Panama, for example, where high malaria rates are associated with local breeding, a village may be of especial danger to more distant localities.

Swamps overgrown with reeds are not always productive of *albimanus*. One-Mile Camp, Panama Division, has a low anopheline and malaria rate. In such localities a mosquito census may save a good deal of expense. Lagoons overgrown with reeds and situated near large rivers may be cleaned out by floods and become dangerous anopheline breeders. The rise of the Sixaola River in December, 1927, is said to have cleared out some such lagoons, among them the one near Margarita which we have described. The malaria rate of Margarita more than doubled between our survey of 1928 and that of 1929.

A mosquito census of houses sufficiently accurate for practical purposes is not difficult. A good inspector can be trained to do the work if he can be made to stick faithfully to his job. Where *Anopheles* are relatively few it is advisable to search for them early in the day, within bed nets. It is not necessary to repeat the census daily, but enough should be done to determine whether the anopheline population is constant or on the wane. The numbers of *Anopheles* should measurably decrease within ten days or two weeks after a successful antilarval operation. The malaria rate of a locality affords a useful index, but it does not give the early and local information demanded.

In camps where antilarval work is indicated, it must be thoroughly and consistently done if it is to be worth while. The immediate results of any anti-malaria operations are often hard to estimate. It is frequently essential to know whether a fault is due to the neglect of the laborer or to the nature of the job. Time and money spent in the proper inspection of the work, therefore, is a good investment. In sanitary procedure, as in business, it is necessary to attend to the bookkeeping if we are to know whether affairs are prospering or not.

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PLASMOCHIN IN MALARIA

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PRELIMINARY REMARKS

In the United Fruit Company's Medical Report for 1927, I submitted the results of certain more or less experimental work which had been done with plasmochin in the treatment of malaria in the Panama Division,—both in the Hospital and in the dispensary clinics. An accompanying report was also rendered by Dr. M. A. Barber and Mr. W. H. W. Komp, both of the U. S. Public Health Service, based upon their observations on this method of treatment and upon certain malaria surveys which they conducted in this Division.

Assuming that my last year's discussion was but preliminary to the resumption of further observations to be presented in this 1928 Report, I have divided this treatment into two distinct parts;—the first dealing only with the Hospital

admissions who were treated by 5 distinct methods of dosage in groups of 100 each, and the second a detailed description of the manner in which we conducted a complete malaria survey of the entire Division and then checked it up by a subsequent survey.

Altogether, 5,382 thick-blood film examinations were made on the 500 cases comprising the 5 series contained in the first part of this report, an average of 10.8 examinations per case.

In the malaria surveys, 3,765 thick-blood films were examined in the first survey and 2,176 in the second. These, with the subsequent tests made in connection with checking up the treatments of the positives, numbered 6,688.

Adding hospital and survey cases together, we get a total of 12,070 thick-blood film examinations made in this Hospital during 1928, in addition to our routine blood smears taken from all cases on admission, and in the dispensary clinic.

PART-I. HOSPITAL MALARIA CASES TREATED BY VARIOUS DOSAGES OF PLASMOCHIN AND QUININE

No reference whatsoever will be made to the chemistry or the pharmacology of plasmochin, nor to the history of animal experimentation and early human therapy of this drug, as these details can all be found in the German literature or in previous numbers of the United Fruit Company Medical Report. In the Almirante Hospital we no longer administer plasmochin alone; we use only the plasmochin compound which is put up in tablets each containing plasmochin 0.01 gm. and quinine 0.125 gm. Smaller tablets have also been on the market which contain just one-half the amount of each ingredient.

As quinine appears to be almost an empirical antidote for the toxicity of plasmochin, we have routinely continued to supplement the dosage of quinine included in the plasmochin compound with additional amounts, because this enhances the effect of the treatment. Plasmochin has a selective therapeutical action on the gametocytes, and quinine tends to destroy the ring forms or asexual parasites. For these reasons, an accurate diagnostic differentiation of the parasites is not so important clinically, since all types can be similarly treated. This differs from the earlier recommendations that plasmochin should be used alone for tertian and quartan malaria and plasmochin compound for the aestivo-autumnal or malignant-tertian type.

In the following 5 groups of 100 cases each, the patients were treated in accordance with a distinct method in each group, irrespective of the severity of the cases or of the types or combinations of parasites. The blood smear was examined each day by the thick-film method in order to check up the efficiency of the treatment. After from 3 to 4 successive blood films had been negative, the patients were discharged, and on their reporting to the outpatient clinic 5 days after their discharge another thick film was examined, and plasmochin and quinine treatment sufficient for 4 days was given them to take at home. In about 5 days they would again report, and a thick film would again be examined.

The patients were then instructed to take our pink tonic tablets (a modification of the Aiken's tonic tablet, each containing 2 grains of quinine) for 8 days, after which period another thick film was examined and if it was negative, the patient was discharged.

In the treatment of children, a larger dosage was used than Young's Rule admits, because in my experience children seem to bear plasmochin better than do adults.

As a certain number of cases relapse or become reinfected after these thorough routine treatments, it was deemed advisable to determine what the percentage of these cases was. Of 897 unselected hospital and dispensary cases treated for malaria with quinine and plasmochin during 1928, 73 or 8.13% relapsed or became reinfected once; 10 twice, or 1.11%; and none more than twice.

The relapses or reinfections in the malaria-survey cases will be discussed under that subject, in Part II of this article.

In attempting to ascertain some method which would yield the most efficient treatment for malaria, and still keep down the dose of plasmochin as low as possible so that patients could be treated safely and efficiently in their homes, thereby economizing both in drug and in hospitalization, five groups were treated with varying dosages of the drugs, and the results of each method are described below. For brevity, and in order to avoid going into every case in detail, only a brief synopsis will be given of each group, in which the interesting cases will be cited. Other treatments were administered coincidentally with the malaria treatment. These comprised operations when necessary; chenopodium, for intestinal helminths; emetine, for amoebic dysentery; and neosalvarsan, bismuth, and mercury for syphilis; etc.

GROUP A

The lowest daily dosage that was considered of possible value was employed in this group, and consisted of plasmochin .03 gm. and quinine sulphate .375 gm. This was divided into 3 equal doses per day.

Of the blood examinations on this series, 88 were aestivo-autumnal, 6 tertian, 4 quartan, and 2 were mixed aestivo-autumnal and tertian; 3 of the patients were under 12 years of age.

None of the cases showed toxic symptoms from the drug, and no case developed haemoglobinuria during the course of treatment. There was 1 death in this series, which will be reported later. No cases showed negative thick-film reports on either the 1st or the 2nd day; 7 were negative on the 3rd day; 20 on the 4th day; 18 on the 5th day; 23 on the 6th day; 14 on the 7th day; 6 on the 8th day; 1 on the 9th day; 4 on the 10th day; 1 on the 11th day; 2 on the 12th day; 1 on the 14th day; and 1 each on the 18th, 19th, and 20th days. The average time was 6.5 days per patient, to free the peripheral blood of parasites.

The cases which ran irregular courses, owing probably to too small a dosage, were as follows:

1. *Case No. 21,691.*—Nicaraguan, male, aged 22. Hb., 70%, *Diagnosis:* Aestivo-autumnal malaria, with a secondary diagnosis of uncinariasis. Under the dosage administered to this series the blood smears did not become negative until the 12th day. The first negative thick films were obtained on the 12th, 13th and 14th days. He was then discharged. On the 19th day he returned to the Hospital feeling well, and without fever, but the thick-blood film was again positive for E.A. malaria. He was given the same dosage to take at home and returned on the 24th day still showing the positive thick film. He was then treated at home in the same way for 4 days more, and returned to the Hospital on the 30th day still showing a positive thick-blood film. On the 36th day he was readmitted to the Hospital and was put on a larger dosage of plasmochin .06 gm. and quinine 1.75 gms. per day, administered in 3 equally divided doses. (One 5-grain quinine tablet, and 2 plasmochin-compound tablets each containing plasmochin 0.01 gm. and quinine 0.125 gm. t.i.d.) On the 39th day, or the 3rd day of this stronger treatment, the blood films became negative. This larger dosage was continued until the 47th day, all daily blood films having continued negative.

2. *Case No. 21,707.*—Costa Rican, male, aged 30. Hb., 70%. *Diagnosis:* Tertian malaria. On the 3rd day gametes appeared and continued present until the 7th day,—after that, all blood smears continued negative.

3. *Case No. 21,764.*—This case had been treated for malaria a year before.—Panaman, male, aged 21. Hb., 70%. *Diagnosis:* Aestivo-autumnal malaria and uncinariasis. Under the dosage given in this series, ring forms alone were found daily until the 9th day; on the 10th day the blood smear was negative. On the 11th day crescents were noted but subsequently the blood continued negative. Chenopodium treatment for uncinariasis was administered on the 17th and again on the 20th day.

4. *Case No. 21,850.*—Panaman, male, aged 19. Hb., 60%. *Diagnosis:* Aestivo-autumnal malaria and uncinariasis. Under the dosage for the series the blood smears were still positive on the 14th day, when larger daily dosages of plasmochin .06 gm. and quinine 1.75 gms. were begun; they were continued until the 23rd day. The blood first became negative on the 16th day, but on the 17th and 18th days crescents were present. The blood continued negative from the 19th day. Chenopodium treatments were given on the 10th and 13th days.

5. *Case No. 22,018.*—Costa Rican, male, aged 23, Hb., 75%. Admitted for aestivo-autumnal malaria and uncinariasis. As thick films continued positive for ring forms on the 13th day, the larger daily dosage of plasmochin .06 gm. and quinine 1.75 gms. was begun on the following day, and the first negative thick-blood film was not obtained until the 18th day; 4 succeeding examinations yielded negative results.

6. *Case No. 22,047.*—Jamaican, male, negro, aged 50. Hb., 65%. Entered the Hospital in a very serious condition from causes other than malaria. Under

the daily dosage of plasmochin .03 gm. and quinine .375 gm. his blood smear became negative on the 3rd day. He died on the 4th day from cardiac insufficiency. Autopsy report showed:

1. Tertiary syphilis
2. Aestivo-autumnal malaria
3. Cardiac insufficiency,—marked decompensation
4. Pulmonary oedema

7. *Case No. 22,064.*—Costa Rican, male, aged 20. Hb., 65%. *Diagnosis:* Aestivo-autumnal malaria and uncinariasis. Crescents continued in blood smears until the 12th day. Chenopodium was given on the 5th and 8th days.

8. *Case No. 22,114.*—Costa Rican, male, aged 20. Hb., 75%. *Diagnosis:* Tertian malaria and uncinariasis. Crescents appeared on the 2nd day (evidently a mixed infection) and continued until the 6th day, after which time all blood films continued negative. Chenopodium was given on the 5th day.

9. *Case No. 22,129.*—Costa Rican, male, aged 21. Hb., 65%. Treated for E.A. malaria. Blood smears continued positive with rings and crescents until the 14th day. Treatment, under the dosage of plasmochin .03 gm. and quinine .375 gm., was continued until the 17th day. The patient was then discharged and sent home without treatment, but returned on the 21st day and, although he had no fever, E.A. rings were again found in thick films. He was given 8 more days of treatment with the same dosage at home, and thick-blood films were negative on the 26th and 31st days.

10. *Case No. 22,148.*—Jamaican, male, negro, aged 24. Hb., 70%. Treated for E.A. malaria. Blood smears became negative on the 5th day; he was discharged on the 8th day and medicine was discontinued. He returned on the 12th day and ring forms were again found in the blood. He was given 4 days' treatment (same dosage) to take at home, and upon his returning on the 17th day, the blood was still positive for E.A. rings. Tonic tablets were then given at home for 6 days, but on the 27th day parasites were still found in the thick films. He was again put on the plasmochin-compound treatment, which he continued to take at home. No crescents were found at any time.

11. *Case No. 22,522.*—Male, Panaman, aged 19. Hb., 75%. Entered the hospital with a fractured leg and E.A. malaria. He was immediately put on the reduced-dosage plasmochin-compound treatment and ring forms appeared in all daily films. A crescent was found for the first time on the 10th day, and the blood smear became negative on the following day. The treatment was continued until the 13th day and smears examined remained negative until the 30th day, when E.A. rings again appeared. The larger dosage of plasmochin-compound containing plasmochin .06 gm. and quinine 1.75 gms. per day was then given for 9 days, whereupon the blood smear again became negative on the 34th day, and continued so until the 52nd day, when the patient was discharged from the Hospital.

All other cases in this series showed an uneventful recovery. One (Case No.

22,454) was heavily infected; the blood became negative on the 7th day and continued so until the 32nd and last day of observation.

Among this group of 100 cases, 15 developed gametes while under treatment with the low dosage of plasmochin compound.

GROUP B

In this series the plasmochin dosage remained the same as in Group A, but was augmented by 1 gm. of quinine per day,—i.e. plasmochin .03 gm. and quinine 1.375 gms. given in 3 equally divided doses. (One 5-grain quinine tablet and 2 plasmochin-compound tablets, each containing plasmochin 0.005 gm. and quinine 0.065 gm., t.i.d.)

There were 92 aestivo-autumnal, 4 tertian, and 4 quartan infections in this group of 100 cases; 4 of them were under 12 years of age.

Only one of these showed any symptom which could be attributed to toxicity from the drug and in that case the symptom appeared in the form of a mild epigastric distress. No case developed blackwater fever and there were no deaths in this series.

The blood films became negative as follows: 2 on the 2nd day; 10 on the 3rd day; 20 on the 4th day; 19 on the 5th day; 26 on the 6th day; 20 on the 7th day; and 3 on the 8th day. The average number of days required to establish negative blood-films in the 100 cases, was 5.29 days per case.

Following are the unusual cases appearing in this series:

1. *Case No. 21,746.*—Young American, male, aged 20. Hb., 70%. *Diagnosis:* Tertian malaria. A year previously he had had malaria, and while being treated with .08 gm. doses of plasmochin, t.i.d., he became cyanotic and had nose-bleed until the plasmochin was discontinued, the treatment being completed with quinine. Under the smaller dosage no toxic signs developed; gametes appeared with ring forms on the 5th day; the thick-blood films became negative on the 7th day and continued so until the 11th day, when all medication was discontinued.

2. *Case No. 21,889.*—Panaman boy, aged 13. Hb., 60%; a cerebral malaria case who entered the Hospital with tetanoid convulsions and was strongly suspected at first of having tetanus. (I reported a similar case, *Journ. Amer. Med. Assocn.*, Vol. 83, pp. 841, 842, Sept. 13, 1924.) The blood smear showed E.A. malaria (heavy infection). He was treated with the dosage indicated for this series, but was closely watched. Crescents appeared on the 3rd day and the blood smears became negative on the 7th day; the treatment, however, was continued until the 14th day, and then the patient was permitted to go home without taking any medicine with him. He returned on the 18th day for reexamination, and even though the blood smear was negative he took treatment at home for 4 days more; and then returned for another thick-film blood examination, on the 23rd day, which was negative. The last blood-film examination, made on the 28th day, was negative also.

3. *Case No. 22,328.*—Jamaican, male, aged 19. Hb., 65%. *Diagnosis:* E.A. malaria. Thick-blood film became negative on the 7th day. Treatment was discontinued on the 10th day and the patient was discharged, to return on the 14th day, when the blood film was still negative. After a course of 4 days' treatment at home, the patient returned for reexamination and crescents were found in the blood smear.

4. *Case No. 22,401.*—Jamaican, male, negro, aged 39. Hb., 70%. *Diagnosis:* E.A. malaria. The blood became negative on the 6th day, when medication was discontinued because of slight epigastric distress, but there was no cyanosis. On the 11th day the blood smears were still negative, and a course of 4 days' treatment was again given without causing any untoward symptoms or signs. The daily blood smears were still negative on the 14th day, when the patient was discharged. Another examination, made on the 19th day, was negative. Tonic tablets were then given for 6 days.

All other cases were cured without any complications. Twelve cases in this series developed gametes while under treatment.

GROUP C

In this series 3 plasmochin-compound tablets, each containing plasmochin .005 gm. and quinine .0625 gm., were given 3 times a day, making a daily dose of plasmochin .045 gm. and quinine .5625 gm. There were 91 E.A., 4 tertian, 4 quartan and 1 mixed E.A. and quartan infections in this group. Eight of the patients were under 12 years of age. Two cases showed some toxic manifestation due to the drug; 1 case developed haemoglobinuria; and there was 1 death. All 4 cases will be described later.

The daily blood-film examinations responded with negative results in the following order: none on the 2nd or 3rd day; 13 on the 4th day; 44 on the 5th day; 25 on the 6th day; 13 on the 7th day; and 1 each on the 8th, 9th and 10th days. Two left the Hospital before negatives were obtained,—one on the 4th and the other on the 8th day. The average time under treatment before blood films became negative, was 5.51 days per patient.

The cases of especial interest are the following:

1. *Case No. 23,005.*—Panaman, female, aged 32. Hb., 50%. Entered the Hospital as a maternity case, and E.A. gametes were found in the routine blood examination. She was immediately put on the treatment indicated for this group. Normal labor took place on the 6th day, parasites disappeared on the 9th day, treatment was discontinued on the 12th day, and she was discharged as cured on the 15th day.

2. *Case No. 23,240.*—Jamaican, negro boy, aged 13. Hb., 50%. Admitted to the Hospital with cerebral malaria, uncinariasis and ascariasis. On the 1st day quinine dihydrochloride 1 gm. was given intravenously, and later on the same day another gram was injected intramuscularly. On the 2nd day, the

routine treatment for the group was begun, and was continued until the 12th day, and was then repeated from the 17th until the 23rd day. The blood smears were first negative on the 5th day and continued so until the 23rd day, when the patient was discharged. *Chenopodium* treatments were given on the 6th, 10th, 21st, and 23rd days.

3. *Case No. 23,297*.—Costa Rican, male, aged 22. Hb.; 70%. Admitted with quartan malaria, uncinariasis and ascariasis. Blood smears became negative on the 6th day. *Chenopodium* treatments were given on the 3rd and 6th days. On the 8th day his lips became quite cyanotic and the plasmochin compound was replaced by quinine 2 gm. per day for 3 days, after which period the patient was discharged.

4. *Case No. 23,466*.—Costa Rican, male, aged 25. Hb., 70%. *Diagnosis*: E.A. malaria and influenza. He developed crescents on the 2nd day and the blood smears became negative on the 5th day. On the 7th day the lips became cyanotic and medicine was discontinued. That night haemoglobinuria set in, but disappeared on the following day. The blood smears continued negative. From the 11th to the 15th day quinine alone, 1 gm. per day, was given with no recurrence of haemoglobinuria; then from the 16th until the 20th day plasmochin .06 gm. per day was given alone and produced no untoward symptoms. As the blood smears still continued negative, the patient was discharged and instructed to take tonic tablets at home. It is difficult to explain the cause of the haemoglobinuria in this case.

5. *Case No. 23,481*.—Costa Rican, male, aged 24. Hb., 70%. Entered the Hospital with haemoglobinuric fever and E.A. malaria. The blood smears became negative on the 5th day, and the plasmochin compound was discontinued on the 6th day. The patient died on the 12th day, from complete anuria.

6. *Case No. 23,498*.—Costa Rican, male, aged 35. Hb., 65%. Entered the Hospital at the same time as the preceding case, also with haemoglobinuric fever and E.A. malaria. The blood smears became negative on the 6th day and the plasmochin compound was discontinued on the 7th day. The blood smears continued negative. The plasmochin compound was again administered from the 12th to the 16th day, and the patient was discharged on the 20th day. He took tonic tablets for 6 days at home, and returned to the Hospital on the 27th day, when the blood was still negative.

Four cases in this series developed gametes while under treatment.

GROUP D

In this series the treatment was the same as in Group C, except that 1 gm. of quinine per day was added, making plasmochin 0.045 gm. and quinine 1.5625 gms.

In this group there were 94 E.A., 1 tertian, 4 quartan, and 1 mixed E.A. and quartan infections; 18 of the patients were under 12 years of age.

One of the patients showed toxic signs or symptoms, and 1 death occurred in the series. Both cases are reported below. No cases developed haemoglobinuria.

The blood films became negative in the following order: 1 on the 2nd day; 3 on the 3rd day; 26 on the 4th day; 43 on the 5th day; 17 on the 6th day; 3 on the 7th day; 3 on the 8th day; 1 on the 10th day; and 1 on the 11th day. One case left the Hospital on the 3rd day. One case, operated for acute appendicitis, died on the 4th day and before the blood smears became negative. Negative blood films were obtained on an average of 4.85 days per case.

The unusual cases in this group are the following:

1. *Case No. 23,255.*—Panaman boy, aged 13. Hb., 65%. Admitted to the Hospital with haemoglobinuric fever, E.A. malaria, uncinariasis and ascariasis. Under the treatment indicated for this group he became cyanotic on the 4th day, when the plasmochin compound was discontinued and glucose solution was given intravenously. He vomited continuously on the 5th and 6th days, and intramuscular injections of quinine dihydrochloride were given, b.i.d., in 1-gram doses for 2 days, after which period, even though the blood became negative on the 3rd day, quinine 1 gm. was given daily until the 19th day. He was discharged on the 30th day. Chenopodium was given on the 24th and 28th days. This case returned to the Hospital about 3 weeks later with influenza, but recovered uneventfully. The blood smears were still negative at that time.

2. *Case No. 23,447.*—Male, Spaniard, aged 22. Hb., 75%. Entered the Hospital with E.A. malaria, but while there he developed bilateral inguinal adenitis. Crescents appeared on the 2nd day, and the blood became negative on the 5th day. The treatment was suspended from the 10th to the 14th day, but was then resumed for 4 days more. A bilateral inguinal adenectomy was done on the 20th day. Daily blood smears continued negative until the 28th day, when the temperature rose to 103°F. and crescents were again found. Treatment was immediately resumed.

3. *Case No. 23,667.*—This case, which was admitted to the surgical service, is reported as follows by Dr. W. S. Dove:

Colored boy, aged 16, was admitted to the Hospital complaining of having had pain in the abdomen for the past 8 days, which had become progressively worse and was accompanied by fever.

Past History.—No previous pain in abdomen, and no serious illnesses.

Present Illness.—Eight days ago began having pain in the right side of abdomen. It was insidious in onset and extended from the costal margin down to the lower right quadrant. The pain was constant and of progressive intensity. Nausea had been present for the past 3 days and he had vomited several times. The bowels had moved every day.

Physical Examination.—Temperature 100°F. Head and neck, negative. Chest: Lungs clear, resonant throughout—no râles. Respirations 20 per minute. Cardiovascular: No murmurs of heart—no enlargement. Pulse of good volume and rate of 90. Abdomen: severe pain and tenderness on pressure

in the upper right quadrant, with rigidity of the right rectus. No tenderness in the lower right quadrant. Spleen palpable. Genito-urinary: normal.

Laboratory Findings:

White-blood count	12,000
Differential white count:	
Polymorphonuclear leucocytes	77%
Lymphocytes	19%
Large mononuclears	4%
Blood positive for E.A. malaria	
Haemoglobin	45%

Progress.—Considering that the patient was positive for malaria, we decided to keep him a short time under malaria treatment. The following day the white-blood cells were 13,000, with polymorphonuclear leucocytes 74%. The 2nd day the number of white-blood cells had risen to 14,000, with 77% polymorphonuclear, and operation was considered advisable.

Operative Report.—Gall bladder normal. Appendix acutely inflamed, oedematous, and hyperaemic. Appendix removed. Oedema of the retroperitoneal tissue over the right kidney was noticed. Both kidneys were enlarged 1.5X. There was no evidence of perforation from gastric or duodenal ulcer. The abdomen was closed without drain.

Post-operative Report.—First day, 9 A.M.; patient passed a comfortable night, pulse 100, temperature 98°F. Patient feels good, but complains of some fullness in the abdomen. At 9.10 A.M. I was called to the bedside and the patient was lying on the bed pan, dead. The ward orderly said that the boy had asked for the bed pan and that it had been placed under him. The orderly also stated that as he stood at the bedside, waiting to remove the pan, he looked down at the patient and saw that he was not breathing. No outcry or evidence of pain had been noted. Considering the 45% haemoglobin of the patient, I consider that the slight exertion of getting on the bed pan resulted in sudden cardiac failure.

The anti-malaria treatment had been the dosage of the series, and had been administered for 3 complete days.

Regarding this same case (23,667) Dr. Ernst Thonnard-Neumann, pathologist, submitted the following post-mortem findings:

Clinical Diagnosis: Acute appendicitis. Male corpse, well nourished and developed. Operation wound, closed by sutures, 5 inches long over the abdomen between the umbilicus and the symphysis. The serosa of the bowels was glistening, there were 2 ounces of clear liquid in the abdominal cavity. The appendix had been removed and there were no signs of a local peritonitis at the caecum; the sutures at the appendix stump were intact. The bladder contained about 150 cc. of clear urine, and the urethral passage was free.

Lungs: normal. Weight of each, 9 oz. Pulmonary arteries free.

Heart: in diastole, apparently too large for size of the body, muscle weak; color of the muscle, a dark purplish red.

Endocardium: The aortic valves were smooth, but the whole ostium was extraordinarily narrow, the circumference being only 4.2 cm. wide, while the valvula pulmonalis was 6 cm. wide.

Aorta: The proximal end near the valves showed some yellow plaques, which were also found in the thoracic section of the aorta. There the vessel was not more than 5 cm. in circumference.

Kidneys: Weight of each, $12\frac{1}{2}$ oz.; large and of a pale pink color. On section, the same pale color was noted. Cortex about 1 cm. wide; no sharp demarcation between cortex and medulla.

Liver: Weight $4\frac{1}{2}$ lbs.; of a dark-gray-green color; lobules fairly distinct. Gall bladder contained some dark brown bile, and the common duct was patent.

Spleen: Weight 12 oz.; slate-colored; fairly soft in consistency; and enlarged.

Brain: Weight $15\frac{1}{2}$ oz. Vessels of the pia mater shone through the dura, the latter glistening; the subdural space was free and the pia mater hyperaemic. On section, the brain was of normal appearance, the ventricles contained a normal amount of cerebral fluid. Thymus, small. Pancreas and suprarenal glands were of normal appearance.

Smear of Bone Marrow: Ring forms of malaria parasites; large amount of clumped pigment.

Smear of Spleen: Great amount of clumped pigment.

Smears from Gray Matter of Brain showed a few pigmented forms of malaria parasites in the capillaries.

Differential Count of Peripheral Blood, taken one hour post-mortem:

Neutrophiles	80%
(Staff forms 21)	
(Young " 22)	
Lymphocytes	14%
Mononuclears	1%
Myelocytes	5%

Meinicke Test from the Peripheral Blood taken one hour post-mortem:

Negative.

Section of Liver: Acute diffuse hepatitis, malaria pigment.

Kidneys: Acute diffuse nephritis; pigment in the glomeruli.

Sections of various organs were sent to Dr. F. B. Mallory, of Boston, who made the following report on microscopic findings:

Microscopic Examination:

Heart: Negative

Liver: The endothelial cells lining the sinusoids were distended with brownish pigment granules. Liver cells negative. Collections of lymphocytes in some of the portal areas.

Pancreas: Negative

Kidneys: Tubules distended; many contain desquamated and necrotic renal cells. Lining epithelium often flattened; occasional mitosis. Some tubules filled with granular material, others with what suggests haemoglobin.

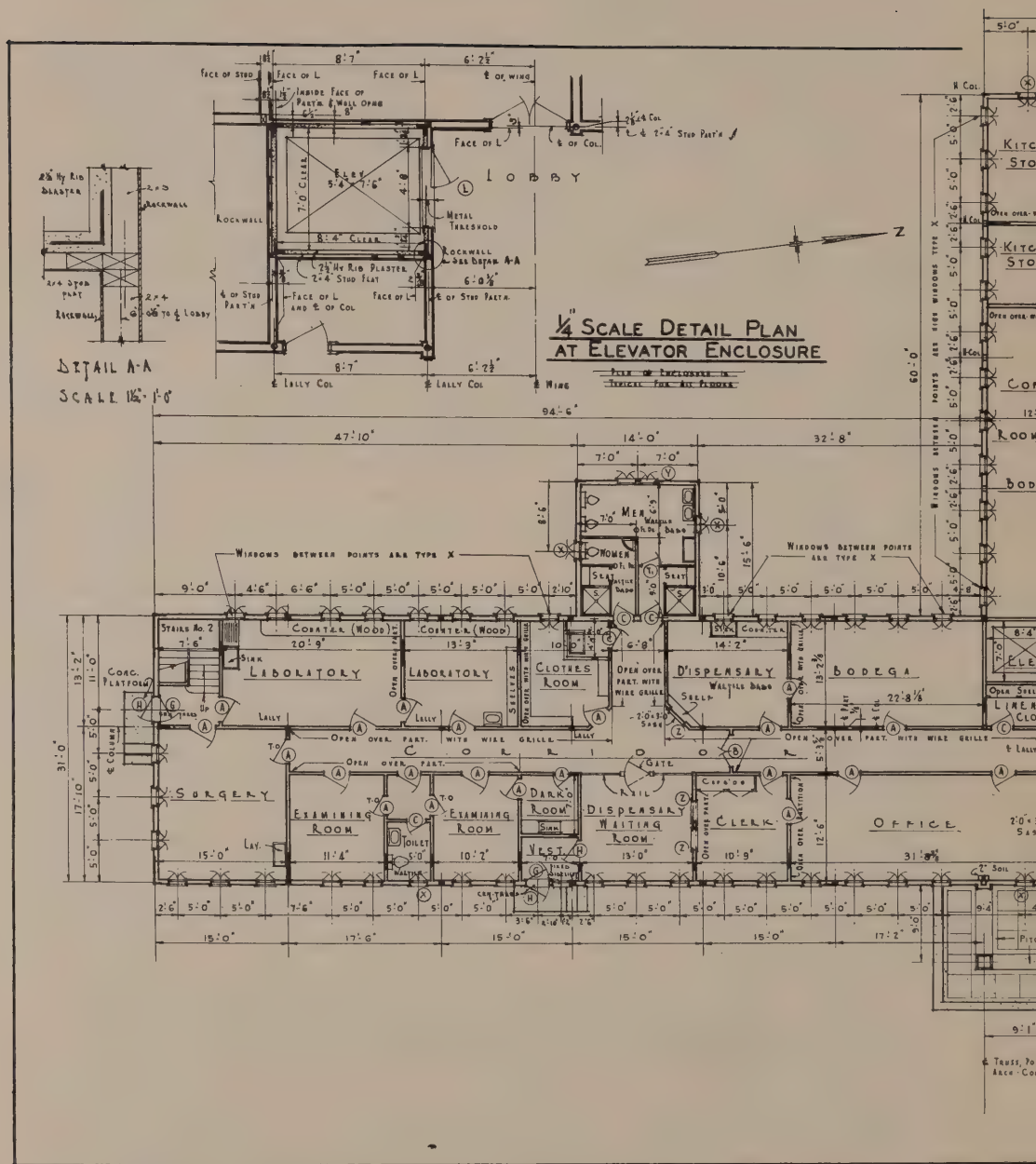
Adrenal: Negative

Aorta: Negative

Microscopic Diagnoses:

Acute tubular nephritis; haemoglobinuria?; malarial pigment in liver.

In this series, 10 cases developed gametes while under treatment.



THIS SKETCH HAS BEEN REDUCED TO APPROXIMATELY TWO-FIFTHS OF THE SIZE.

GROUP E

Plasmochin .06 gm. and quinine 1.75 gms. per day were given in this series, in 3 equally-divided doses—just double the Group A plasmochin dosage, but with the addition of three 5-grain quinine tablets. There were 86 cases of E.A. malaria, 10 tertian, 3 quartan, and 1 mixed E.A. and tertian.

In this group there were more children than in any other; 40 of the series were under the age of 12.

Four of the cases showed some toxic symptoms or signs from the drug; no case developed haemoglobinuria, and there were no deaths in this entire series.

The order in which the blood smears became negative was as follows: 1 on the 2nd day; 3 on the 3rd day; 20 on the 4th day; 31 on the 5th day; 23 on the 6th day; 13 on the 7th day; 3 on the 8th day; 2 on the 9th day; and 1 on the 10th day. Three cases were discharged, 1 on the 3rd day, 1 on the 4th day, and 1 on the 8th day, before negative smears were obtained. It required, on an average, 5.43 days per case to free the peripheral blood from parasites.

The only unusual cases in this series were those who showed some symptoms of intoxication from the drug:

1. *Case No. 21,810.*—Jamaican, negress, aged 23. Hb., 65%. Admitted for E.A. malaria and uncinariasis. The blood became negative on the 6th day and continued so on the 7th, 8th and 9th days. Chenopodium was given on the 8th day. The patient suffered from slight gastric distress on the 6th day, but the medicine was continued until the 9th day. There was no cyanosis nor any further untoward symptom or sign.

2. *Case No. 21,868.*—Panaman, female, aged 36. Hb., 65%. *Diagnosis:* E.A. malaria. Gastric distress began on the 4th day, but the medicine was continued 4 days longer without further toxic symptoms. The blood became negative on the 6th day and remained so on the 7th and 8th days.

3. *Case No. 22,187.*—Costa Rican girl, aged 8 years. Hb., 70%. Admitted with E.A. malaria. She was given plasmochin .03 gm. and quinine 1 gm. per day. She developed crescents on the 3rd day, and the blood was negative on the 5th day, when she developed clonic convulsions, which continued intermittently for 3 days. The same dosage of the drugs was continued, however, until the 11th day, inclusive. She was then discharged, and returned on the 16th day; when her blood film was still negative. She was given 4 days' treatment to take at home. Upon her return, on the 21st day, the blood was still negative. It was also negative on the 28th and 35th days.

4. *Case No. 22,463.*—Costa Rican, male, aged 27. Hb., 80%. *Diagnosis:* E.A. malaria. Developed cyanosis and gastric pains on the 8th day. The blood became negative on the 7th day, and the treatment was discontinued on the 10th day. The blood film was again negative on the 14th day, when he was discharged. Half dosage was then given him to take at home for 4 days, and upon his return on the 19th day the blood film was again negative.

5. *Case No. 22,557.*—Young Panaman, mulatto, aged 20 years. Hb., 70%. Relapsed with E.A. malaria just 2 weeks after a previous attack, during which he was treated in Group B. This time he entered the Hospital with haematemesis also. Crescents appeared on the 5th day. The blood became negative on the 8th day, but the treatment was continued until the 12th day, with negative blood films. He was then discharged. He returned on the 16th day; the blood film was again negative, and treatment was given to be taken at home for 4 days. On the 21st day the blood film was still negative, and after his taking tonic tablets for 6 days the blood film was again negative on the 28th day.

6. *Case No. 21,788.*—Jamaican, negress, aged 36. Admitted to the Hospital with cerebral malaria. On the 1st day quinine 1 gm. was given and on the 2nd day she received 3.66 gms. of the same drug, of which .66 gm. was injected intravenously. Thereafter the routine treatment for the series was administered. The blood became negative on the 7th day, and the medicine was discontinued on the 14th day. Later, treatment with half dosage was given the patient to take at home for 4 days after which tonic tablets were taken for 6 days. Daily blood smears continued to be negative up to the 24th day, when they were discontinued.

Nine cases in this series developed gametes while under treatment.

PART II. MALARIA SURVEYS IN WHICH ALL POSITIVE CASES WERE TREATED IN THE OUT-PATIENT CLINIC WITH PLASMOCHIN AND QUININE

FIRST DIVISIONAL SURVEY

A complete survey was made of each and every farm and camp in the Panama Division, after which all positives were treated as follows:

They were given 4 days' treatment to take at home. On the 5th day the blood was examined and again 4 days' treatment was given them to take at home, after which they were instructed to take tonic tablets for 8 days more. The daily dosage used was plasmochin .06 gm., and quinine 1.75 gms. for the average adults, with modified dosages for children.

In this first divisional survey 3,765 people were examined; 736, or 19.55% of them were 12 years of age or younger. In all, 477, or 12.67% were found positive for malaria; 433 aestivo-autumnal, 28 tertian, 13 quartan, and 3 mixed infections. Of the positives, 160, or 33.54%, were 12 years of age or under. Of the 375 cases that received a complete course of treatment, 23, or 6.13%, were still positive after 4 days' treatment, and only 2 remained positive after treatment for 8 days. However, after 8 days only those were examined who had been found positive after 4 days' treatment. None showed any evidence of intoxication attributable to the drug.

SECOND DIVISIONAL SURVEY.

In order to check up the first survey, after a few months' interval another survey was made of each camp and farm. In this survey, however, the individuals who were found positive for malaria were given 6 days' treatment to take home, with the same daily dosage as that given in the first survey. On the 7th day another blood smear was examined, and treatment for 6 days was repeated.

In this second divisional survey 2,176 persons were examined; 466, or 21.42% of them were 12 years of age or younger. In all, 314, or 14.43% were positive for malaria; 270 aestivo-autumnal, 22 tertian, 17 quartan, and 5 mixed infections. Of the positives, 102, or 32.48%, were 12 years of age or younger. Of the 254 cases that received a complete course of treatment, 20, or 7.87% were still positive after 6 days' treatment. No one was examined after 12 days' treatment.

COMMENTS ON BOTH SURVEYS

In all, 5,941 cases were examined in the two surveys. Owing to the shifting of laborers and their families from camp to camp, it was difficult to keep an accurate check on all who were examined, but of those of whom we were able to keep records 1,387 were examined twice, of whom 130 were found positive during the first survey, and 181 during the second survey; while 33 were found positive at both examinations. A complete table of the work done during both surveys is shown on page 66.

It was surprising to note the advanced ages of many of our laborers. The average age of 1,405 laborers examined in the first survey was 40.16 years, and that of the 936 laborers examined in the second survey was 40.77 years. In the first survey, 453, or 32.24% of the laborers were 45 years of age or older; and in the second survey, 314, or 33.55%.

SUPPLEMENTARY NOTES AFTER MALARIA SURVEY REPORTS

O. T. BROSIUS, M.D.

United Fruit Company Hospital

Almirante, Panama

Channels for Efficient Malaria-Control.—To be extremely efficient, malaria-control in a given community should be conducted through the following channels:

1. *Sanitation.* All anopheline breeding places within probable flying distance from the camp must be treated either with Paris-green dusting powder or with oil, the former being cheaper and generally more satisfactory.

2. *Treatment.* All inhabitants should be examined by means of regularly conducted surveys by the thick-film method, and all positives should be treated thoroughly with plasmochin and quinine.
3. *House-to-House Inspection* for adult mosquitoes should be made, and the inhabitants should be taught the probable resting places and encouraged to use generous applications of "Flit," or a mixture 2 parts of carbon tetrachloride with 100 parts of kerosene, or some other similar insecticide agent.
4. *Screens*, of course, have their importance but general use is not practicable in our labor camps.
5. *Quinine Prophylaxis* has some virtues and is practical, but must be administered over long periods. It is curative rather than preventive.
6. *Education* is of paramount importance where the methods of infection are taught, along with prophylaxis and the importance of prompt treatment.
7. *Quantity and Quality of Food.* These factors are important in keeping the inhabitants in a better state of health by maintaining the bodily resistance at a higher level and thus enabling the individuals to be better fortified to combat the invasion of any infection such as malaria.

Plasmochin as a Sole Sanitary Agent.—Theoretically, much should be expected from treatment alone, assuming that quinine destroys the asexual parasites and plasmochin the gametes. To put this more or less hypothetical assumption to a crucial test, we disregarded sanitation, that is, mosquito-control, almost entirely in the Panama Division during 1928, in order to try to determine the true status of plasmochin as a sanitary factor. A description of the manner in which the plasmochin compound was applied with this end in view is recorded in complete detail in another report, "Plasmochin in Malaria," Section 2,* wherein it is shown that the second annual survey revealed a slight increase in the malaria rates as compared to the first survey. This was really the first intimation we had that we might be expecting too much of plasmochin as a sole sanitary agent. Some two months after the second 1928 survey had been concluded, Dr. M. A. Barber, Mr. W. H. W. Komp, and Mr. Barclay Newman, of the U. S. Public Health Service, again returned to our Division for certain special malaria studies, and at first were disappointed because, although they found a sufficient number of infected individuals in their surveys, none of the cases were heavy enough to be of sufficient interest for their purpose. We attributed this to the excellent effect which plasmochin must have had on sanitation in general, but we were doomed to disappointment when we obtained the results from surveys of other camps.

Comparative Survey Data.—The surveys in the various divisional camps and

* See page 63 of the present *Annual Report*.

CAMPS AND FARMS TREATED IN 1928 DIVISIONAL SURVEYS

Marginal No.	Name of Camp	First Survey				Second Survey					
		Date	Total Examined	Positives	Percentage Positive	Conducted by	Date	Total Examined	Positives	Percentage Positive	Conducted by
1	Farm 4	3/15	214	19	8.88	Brosius and Smith	10/4	135	16	11.85	Brosius and Neumann
2	Farm 10	4/2	105	19	18.10	"	10/5	72	9	12.50	"
3	Farms 8 and 9	4/9	120	13	10.83	"	Not done	Not done	Not done	Not done	"
4	Base Line	5/2	118	24	20.34	Brosius and Maltzberger	8/16	93	29	31.18	Clark and Neumann
5	Farms 2 and 3	5/16 and 24	221	17	7.69	"	10/11	127	12	9.45	Brosius and Barnett
6	Farms 1, 5 and 6	5/31	146	6	4.11	"	10/12	157	19	12.10	"
7	Miscellaneous	6/7 and 14	177	8	4.52	"	10/12	29	4	13.79	"
8	Costa Rica	6/21	51	7	13.73	"	10/18	56	7	12.50	"
9	La Palma	6/21	28	1	3.57	"	10/18	39	6	15.38	"
10	Virginia	6/28	74	2	2.70	"	10/19	61	6	9.84	"
11	Sixaola Banana Co.	6/28	46	3	6.52	"	Not done	Not done	Not done	Not done	"
12	Favorita	7/5	12	2	16.67	"	10/19	12	2	16.67	"
13	La Celia	7/5	42	3	7.14	"	10/19	40	10	25.00	"
14	Daytonia	7/5	120	10	8.33	"	8/16	103	20	19.42	Clark and Neumann
15	Zavala	7/5	21	0	—	"	10/19	15	5	33.33	Brosius and Barnett
16	Paraiso	7/5	55	3	5.45	"	10/19	56	9	16.07	"
17	Catarina	7/12	44	3	6.82	"	10/19	41	5	12.20	"
18	Margarita	7/19	114	11	9.65	"	11/1	96	16	16.67	"
19	Olivia	7/26	43	1	2.33	"	11/1	40	6	15.00	"
20	Feilds	7/26	32	1	3.13	"	11/1	49	8	16.33	"
21	Chase	7/26	88	8	9.09	"	11/1	56	8	14.29	"
22	Suretka	8/2	77	10	12.99	Brosius and Neumann	11/2	111	13	11.71	"
23	Bratsi and R. R. Gang	8/2	28	1	3.57	"	Not done	Not done	Not done	Not done	"
24	Lari (Talamanca)	8/17	92	22	23.91	Clark and Neumann	11/2	78	12	15.38	"
25	One-Mile	Jan.	339	32	9.44	Barber and Komp	8/16	100	13	13.00	Clark and Neumann
26	Dos Caños	Feb.	150	41	27.33	"	9/6	103	7	6.80	Brosius and Barnett
27	Guabito (3 surveys)	Jan., Aug. and Sept.	647	118	18.24	Barber, Komp, Clark and Neumann	11/16	71	11	15.49	"
28	Barranco	8/17	40	7	17.50	Clark, Brosius and Neumann	11/8	45	4	8.89	"
29	Isla Grande	8/31	67	11	16.42	Brosius and Neumann	11/9	48	10	20.83	"
30	Nievecita	8/31	30	7	23.33	"	11/8	35	9	25.71	"
31	San San	9/6	116	34	29.31	"	11/15	93	12	12.90	"
32	Elena	9/17	49	12	24.49	"	11/8	40	8	20.00	"
33	Senosri and Sibubi	9/17	137	10	7.30	"	11/8	50	7	14.00	"
34	Las Delicias	9/14	52	7	13.46	"	11/2	51	4	7.84	"
35	California	9/20	70	4	5.71	"	11/9	74	7	9.46	"

towns conducted by Dr. Barber, Mr. Komp and Mr. Newman showed the following results compared with our two previous 1928 surveys:

Name of Camp	Barber, Komp and Newman Survey				Second Divisional Survey				First Divisional Survey			
	Date	Total Examined	Positives	Percentage	Date	Total Examined	Positives	Percentage	Date	Total Examined	Positives	Percentage
Base Line	12/23/28	89	16	18.00	8/16/28	93	29	31.07	5/ 2/28	118	24	20.33
Guabito	12/27/28	100	18	18.00	Nov. '28	71	11	15.49	Jan. and Aug.	647	118	18.23
San San	12/28/28	68	11	16.1	11/15/28	93	12	12.90	9/ 6/28	116	34	29.31
Farm 10	1/ 1/29	57	11	19.3	10/ 5/28	72	9	12.50	4/ 2/28	105	19	18.09
Daytonia	1/ 3/29	60	9	15.00	8/16/28	103	20	19.41	7/ 5/28	120	10	8.03
Zavala	1/ 3/29	13	1	7.7	10/19/28	15	5	33.33	7/ 5/28	21	0	0.00
Farm 4	1/ 8/29	75	10	13.3	10/ 4/28	135	16	11.85	3/15/28	214	19	8.87
Farm 1	1/ 8/29	43	5	11.6	10/12/28	157	19	12.10	5/31/28	146	6	4.01
Farms 5 and 6	1/ 8/29	66	13	19.7								
Dos Canos	1/10/29	56	22	39.3	9/ 6/28	103	7	6.79	Feb. '28	150	41	27.33
Elena	1/10/29	59	14	23.7	11/ 8/28	40	8	20.00	9/17/28	49	12	24.48
One-Mile	1/15/29	62	10	16.1	8/16/28	100	13	13.00	Jan. '28	339	32	9.48
Olivia	1/15/29	33	7	21.2	11/ 1/28	40	6	15.00	7/26/28	43	1	2.32
Feilds	1/15/29	53	14	26.4	11/ 1/28	49	8	16.32	7/26/28	32	1	3.12
Margarita	1/17/29	75	35	46.6	11/ 1/28	96	16	16.33	7/19/28	114	11	9.64
Farms 2 and 3	1/29/29	86	21	24.4	10/11/28	127	12	9.44	5/16/28	221	17	7.64
Chase	2/12/29	50	18	36.00	11/ 1/28	56	8	14.28	7/26/28	88	8	9.09
Totals		1,045	235	22.48		1,350	199	14.74		2,523	353	13.99

The rate of positives showed a considerable increase in the last survey made by Dr. Barber and Mr. Komp. There is this to be considered, however,—that special experts would be expected to find a higher percentage of positives than men of lesser experience, especially when they found among their positives a considerable number of very low infections. The great majority of these low infections were absolutely without symptoms, and I believe that this predominance of non-sick malarial positives may be easily attributable to the effects of our wholesale quinine and plasmochin distribution. Another consideration worthy of mention is that in our surveys we tried to include every one who belonged to the camp; while in this last survey conducted by Dr. Barber and Mr. Komp we examined only the number that happened to be in the camps, which included chiefly the women and children, and such men as were not at work because of illness.

The survey made by Dr. Barber and Mr. Komp included also the following camps which we are unable to compare with previous surveys:

Name of Camp	Date	Number Examined	Positives	Percentage of Positives
San San School	1/31/29	69	21	30.4
Spanish School (Almirante)	2/ 1/29	70	6	8.6
Chiriquicito	2/ 9/29	80	56	70.
Bocas del Toro Schools	1/10/29	121	41	33.9
Careening Cay	1/10/29	30	8	26.6
Shepherd Island	2/13/29	29	9	31.
Totals of Previous Series (<i>q.v.</i>)		1,045	235	22.48
Total for Barber-Komp Survey		1,444	376	26.03

The totals for the two 1928 surveys were as follows:

	Number Examined	Positives	Percentage of Positives
First Survey	3,765	477	12.66
Second Survey	2,176	314	14.52

Conclusions from the Surveys.—Margarita gave us our first disagreeable surprise. After Dr. Barber's and Mr. Komp's survey, when they found a percentage of 46.6 positive, Dr. W. E. Deeks, General Manager of the Medical Department of the United Fruit Company, who happened to be in the Division at that time, called a conference to be held at Margarita. There Mr. Komp, and Dr. Ralph Collins of the Rockefeller Foundation who was also then visiting the Division, found numerous engorged anophelines (*albimanus*) in a thorough house-to-house inspection made by them jointly. Several surveys were made by Dr. M. A. Barber and Mr. J. A. Corrigan, Chief Sanitary Inspector of the United Fruit Company, before the breeding places of these mosquitoes were found, which proved to be an extensive marshy area bordering on a lagoon at a distance of from one-half a mile to one mile from the camp. Complicating the situation, the fact was noted that Margarita was the end of the trail across the hills to Port Limon and travelers were constantly bringing fresh infection to this camp.

Upon the theory that the finding in a community of an infection as high as 46.6% meant a probable actual infection of twice that percentage, blanket treatment was decided on to include two of the nearby camps, Olivia and Feilds, which had also shown comparatively high rates of infection. Before instituting this treatment, Dr. Barber and Mr. Komp made another survey of Margarita in which practically the same percentage of infection was discovered.

Blanket Treatment for Three Camps.—The blanket treatment for the three camps, Margarita, Olivia and Feilds was then conducted as follows:

One of our reliable attendants was assigned the duty of beginning with Margarita, where he was instructed to give to every resident of the place 2 quinine tablets of 5 grains each, and 2 plasmochin-compound tablets each containing plasmochin .01 gm. and quinine .125 gm., twice a day for 2 days. Thus each adult was to receive plasmochin .04 gm. and quinine 1.85 gms. per day; and the dosage to children was modified in accordance with Young's Rule. The attendant had instructions to leave with each individual 12 quinine tablets of 5 grains each, and 12 pink tonic tablets (Aiken's formula plus 1 grain of quinine)—in order that 1 tablet of each might be taken 3 times a day for 4 days—and then to proceed to Olivia, giving 2 days' treatment there to each resident, and to conclude the week with Feilds, leaving the same drugs with the people in each place. This procedure was repeated during a 2nd and a 3rd week, so that every person in each camp should have received 6 days of actual plasmochin and quinine treatment, which was to be taken in the presence of the dispenser; and quinine and tonic tablets were to be taken between these treatments.

Most of these cases cooperated very well when the need of the treatment was explained; but it was impossible to administer it to all, as there was no way of compelling them to cooperate, and those who evaded the treatment simply kept out of the dispenser's way. The attendant, however, reported the following successes in dispensing the drugs:

Margarita—145 People in Camp

	First Treat- ment	Second Treatment	Third Treatment
Number of persons who received all 4 doses during	59	75	61
Number of persons who received 3 doses during	30	2	18
Number of persons who received 2 doses during	29	28	21
Number of persons who received only 1 dose during	12	6	1
Totals	130	111	101

This shows that about three-quarters of the people received some of the treatment each time, and that well over one-half of these received the full dosage.

Olivia—55 People in Camp

	First Treat- ment	Second Treatment	Third Treatment
Number of persons who received all 4 doses during	45	36	42
Number of persons who received 3 doses during	1	2	2
Number of persons who received 2 doses during	3	9	4
Number of persons who received only 1 dose during	0	0	3
Totals	49	47	51

Feilds—74 People in Camp

	First Treat- ment	Second Treatment	Third Treatment
Number of persons who received all 4 doses during	0	61	60
Number of persons who received 3 doses during	4	0	3
Number of persons who received 2 doses during	60	7	7
Number of persons who received only 1 dose during	0	1	0
Totals	64	69	70

Results of Blanket Treatment.—After the 3 weeks' blanket treatment was completed, Dr. Barber and Mr. Komp made another survey of these 3 camps, which showed the following percentage of infection in those camps:

Margarita	56	examined,	11	positive,	or	19.7%
Olivia	41	"	4	"	"	10%
Feilds	46	"	7	"	"	15.2%

As the attendant also had orders to encourage adult mosquito destruction within the houses, Mr. Komp found very few mosquitoes in the houses at Margarita during a house-to-house inspection at the end of the three weeks.

Broad Adoption of Blanket Treatment.—We are now continuing the blanket treatment throughout all of the camps and towns, and a trained sanitary inspec-

tor for the Division has already been engaged, in order that strenuous measures may be taken at once to inhibit the breeding of anophelines near towns and camp sites, and to destroy the adult mosquitoes within the houses. A report will be made later, recording the results obtained by this combined method of attacking the malaria increase which has arisen in this Division.

Plasmochin, Alone and with Quinine: Special Remarks.—It is of great importance to know just how much plasmochin is required to inhibit the development of oocysts, and equally important to know just how long the plasmochin is effective. This, however, is not the only value of the drug. In this Hospital we are quite convinced that the combination of quinine with plasmochin is more effective in destroying the asexual parasites than is quinine when administered alone.

Plasmochin is now put up in the form of ampoules for intramuscular and intravenous therapy. In order to determine its approximate value when administered alone intramuscularly, Dr. Ernst Thonnard-Neumann of our hospital staff injected, in a series of unselected cases, 1 ampoule of .03 gm., and 4 hours later sent a thick-blood film from the patient to Dr. Barber and Mr. Komp for examination; and 4 hours after a 2nd injection of plasmochin .03 gm., he sent them another thick-blood film to ascertain what increased therapeutic value might have been derived from the 2nd injection. The results of the thick-film examinations were as follows:

Case	Blood Examination Before Treatment	Four Hours Later, i.e., After 1st Plasmochin Injection	Eight Hours Later, i.e., After 2nd Plasmochin Injection
1	223 E.A.° per 218 W.B.C.	476 E.A.° per 57 W.B.C.	820 E.A.° per 83 W.B.C.
2	1160 " " 148 "	1320 " " 162 "	1460 " " 267 "
3	Very numerous E.A.°	About 2 E.A.° per W.B.C.	About 1 E.A.° per W.B.C.
4	7 E.A.° per 84 W.B.C.	0 E.A.° per 4 W.B.C.	57 E.A.° per 21 W.B.C.
5	9 E.A.° " 25 fields	2 E.A.° " 20 fields	2 E.A.° " 50 fields
	1 E.A.° " 10 "		
6	6 E.A.° " 100 "	2 E.A.° " 25 "	2 E.A.° " 25 "
7	Rare E.A.°	No parasites	No parasites
8	4 E.A.° per field	2 E.A.° per field	1 E.A.° per field
9	9 E.A.° " 10 fields	4 to 5 E.A.° per field	E.A.° fewer
10	Few E.A.°	E.A.° very few	
	1 E.A.°	E.A.° few	E.A.° few
11	2 E.A.° per field	15 E.A.° per field	10 E.A.° per field
12	1 E.A.° " "	51 E.A.° per 2000 W.B.C.	Not done

W.B.C. means white-blood cell

o means ring

c means crescent

Parasite Tolerance to Plasmochin.—In concluding these supplementary notes, there is one other item which should not be overlooked. It concerns the tolerance for plasmochin which may be acquired by parasites. For more detailed information regarding this subject, I wish to refer to Schellworth's article in the *Muenchener Medizinische Wochenschrift* of February 15, 1929. Therein it has been demonstrated that malaria parasites which had been taken from individuals who had been treated with plasmochin were particularly resistant to plasmochin treatment when reinjected into other individuals for the purpose of psychopathic therapy.

THE FIELD PARASITE RATE FOR MALARIA IN THE BANANA DIVISIONS

(Mainland of Central America)

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Method of Procedure.—The field surveys for the summer of 1928 were made in only one or two of the labor camps in each of the agricultural districts of the mainland divisions. I selected, as a rule, those camps that revealed the highest records of hospital admissions for malaria fever during the first half of the hospital year. The exceptions to this rule were the two Panama divisions (Chiriqui Land Company and Almirante). In the former every one was examined, while in the latter the geographical distribution of the large camps and the presence of extensive potential anopheline breeding areas determined the selection of the camps to be examined.

Men, women and children were examined, and in most cases the camp personnel was represented by the people found in the camp during working hours. It will be realized, therefore, that the rates obtained do not represent the rates that would have been recorded had I examined cross sections of the population taken from the best, medium and worst camps in each of the agricultural districts of the various divisions.

THE PARASITE RATE—BANANA DIVISIONS (Thick-Film Method)

Divisions	Number Examined	Rate Positive (%) for Malaria
Colombia	689	15.2
Tela R. R. Co.	622	18.6
Costa Rica	752	19.0
Almirante	544	22.9
Guatemala	709	27.6
Truxillo R. R. Co.	488	35.0
Chiriqui Land Co.	1,377	35.6

Colombia.—This Division is an irrigation project but contains one district (Tucurinea) that is similar in all respects to other banana divisions. The draglines* built through the area have very greatly assisted in the control of malaria in camps that were formerly heavily infected. In addition to this assistance, some very good anti-malaria work has been done in regular camp treatment, larva control, and the white-washing of the inside walls of the labor camps.

* A dragline is an extensive drainage channel constructed on a scale large enough to drain lagoon and swamp regions. (See Figures Nos. 1, 2 and 3, Pages 72, 74 and 76.)



A. DRAG-LINE DREDGE IN OPERATION.

The majority of the camps have well-ventilated and well-lighted ceilings and roofs, owing to improvements made during the past year.

Tela.—The Division of the Tela Railroad Company has also been greatly benefited by draglines dug through the Progreso, Ulua and Guaymas Districts. This Division has a dispensary service that assists the same districts. Tela has one very bad area, in the San Alejo region about 15 kilometers west of Tela, which accounts for most of its malaria. This area received very little attention in any branch of anti-malaria work, except for the cases that seek admission to the Hospital.

Costa Rica.—The division made but little progress in lowering its field or hospital rates until shortly before the present survey. The field rate has fallen to a much lower level than was to be anticipated. This seems to be due more to recent camp treatment than to anti-larva control and drainage. There is a wide expanse of potential breeding surfaces in this Division, but the drainage required to correct conditions would entail great expense.

Almirante.—Long-interval quinine and plasmochin camp treatments have been given to more than half the camps in this Division. Medical control, rather than mosquito control, has been relied upon. Experience seems to indicate that far more frequent camp treatments are necessary if medical control alone, is to be employed.

Guatemala.—The camps in the agricultural districts of this Division have been greatly improved by frequent treatment with quinine and plasmochin, and by camp sanitation and mosquito control. This is another division with many large breeding areas (not far from camp sites) which cannot be drained economically nor regularly treated. I consider that the control work in the Los Andes District is superior to that done in any other district of the banana divisions. The hospital rate of this Division remains high because of the large personnel admitted from the railroad company (I.R.C.A.), which is not under our sanitary supervision.

Truxillo Railroad Company.—The camp sites are kept reasonably clean, but the mosquito control work, until quite recently, was almost nil. Medical service in the camps has not been successfully nor consistently conducted. Both the hospital and field rates for malaria appear unreasonably high. The Division offers about as much natural difficulty, however, in the amount of potential breeding surfaces and the length of its railroad lines as the Costa Rican Division.

Chiriqui Land Company.—This is a new Division in which the clearing of jungle land and the planting of bananas are proceeding at the same time. A large railroad personnel is also present within the division limits, constructing a railroad line that will later serve the fruit area. Scattered labor gangs, living under the most primitive conditions and surrounded by large and numerous breeding areas, offer a serious problem in malaria control until the life of the Division is a little more advanced. Anti-mosquito work has been started, accompanied by frequent field surveys and treatment.



B. DRAG-LINE DITCH IN PROCESS OF CONSTRUCTION

Survey of Carib Villages.—I surveyed three Carib villages located at the edge of the Divisions in Honduras and Guatemala and found that their parasite rate was 42%. It was based chiefly on examination of women and children. No anti-malaria measures are in use in these villages, and they offer an interesting comparison.

Species Incidence of Malarial Parasites (%)

Aestivo-autumnal	60.9
Aestivo-autumnal and tertian	3.8
Aestivo-autumnal and quartan	0.2
Tertian	31.1
Quartan	3.9

The rate of aestivo-autumnal parasites is lower than in former surveys, owing to the fact that in 2 or 3 areas tertian epidemics were found. The usual field rate revealed for the aestivo-autumnal species is from 70% to 75%.

The rate of "crescent carriers" found in the cases of aestivo-autumnal infections, was 21.5%. This rate varied somewhat in the different divisions.

The rate of heavy infections found in the total number of positives was 21.7%. I list a case as a heavy infection when 5 or more parasites are present in the average microscopic field examined in the thick film.

Comparison of Lowland and Highland Parasite Rates

	No. Exam.	Para- site Rate (%)
Children (lowland—banana zones)	1,161	33.2
“ (highland—coffee zone)	196	8.6
Adults (lowland—banana zones)	4,032	26.5
“ (highland—coffee zone)	112	7.1

Comments.—Nearly half of the children with positive blood in the highland group had never visited the lowlands, while all others found positive were individuals who had made visits to the lower levels.

I took the opportunity in 3 banana divisions to learn the number of cases from the camps that were being treated for malaria in the hospitals on the day that I examined these same camps. The 3 divisions had a total of 26 cases under treatment for malaria in the hospitals, and on the same date 555 people in these camps revealed blood films positive for malaria; 137 of these 555 people had just as severe infections, microscopically, as those who were undergoing treatment in the hospitals.

This clearly demonstrates the serious loss of labor days due to malaria in the divisions, and serious attention should be focused on the economic importance of remedying such conditions.

The greatest single factor that has had a lasting beneficial effect in lowering the field rate for malaria in our banana zones during the last three years has



C. COMPLETED DRAG-LINE DITCH

been the building of draglines (already referred to) that have either obliterated or greatly reduced the size of large mosquito-breeding areas. These draglines were, of course, built primarily for agricultural reasons, but they permit collateral drainage that greatly assists in protecting camp sites. Attention is called to their sanitary effect, in the hope that the building of them may be planned early in the life of a division instead of waiting until late.

A regular field medical service, short radius control of mosquito breeding, and killing mosquitoes in quarters are, in a sense, only palliative; but nevertheless these methods, if systematically applied, are important in the *saving of labor days*.

A COMPARISON OF THE SPLEEN AND PARASITE RATES AS MEASURES OF MALARIA INCIDENCE IN THE RACES OF THE MAINLAND OF CENTRAL AMERICA¹

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Continuation of Investigation.—The summer of 1928 afforded me a further opportunity to compare the spleen and parasite rates as measures of malaria incidence in seven different regions of Central America. All of the examined areas were in the fruit zones, the low coastal plains of the mainland. Two control areas, each in a different country, were also examined in the coffee levels that lie at an elevation far above the banana zone.

It will be recalled that a report was made on this subject in 1927.² That report consisted of an analysis of a large field study of Haitian negro male adults and Haitian children. Further records were added from my autopsy experience in the Panama Canal Zone and at Tela, Honduras. I did not have actual comparative field records on the Latin-American race of the low mainland of Central America nor on the negro races living for a long period in these same locations with Latin-American labor.

Methods of Procedure.—I selected for examination, as a rule, the labor camps showing the highest malaria morbidity rate for the first half of the year, but in one new banana plantation every one was examined who lived within the limits of the Division. All women and children, and any men not engaged at the time in plantation duties, were included in the tests.

The spleen index was determined in each division by one or more of our doctors who possessed long experience in the medical wards of the Company and in other hospitals. In every division except one, the people were examined in a recumbent position with the legs drawn up and the spleen palpated at the end

1. For list of abbreviations used in the tables, see the end of this paper.

2. See *Sixteenth An. Rept.*, 1927, Med. Dept., United Fruit Co., p. 86.

of deep inspirations. In that other division the standing or the sitting position was used and the clothing was merely loosened over the splenic area.

The parasite index was obtained by the use of the thick-blood film prepared and examined as indicated in my previous reports.

I will record the enlarged spleens found by size,—that is, any spleen which was felt with difficulty or which did not extend 1 finger below the costal margin on deep inspiration will be entered as +, while those that extended below the costal margin will be entered as +1 finger, +2 fingers, +3 fingers, etc. The first tabulated result will be by race and size, without regard to highland or lowland residence.

ENLARGED SPLEENS BY RACE AND SIZE

Race	Total Enlarged Spleens	+	1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	12 +
Latin-A.	1,714	622	408	359	168	89	38	15	7	4	2	1	1
West-Ind.	213	138	30	29	5	4	4	1	0	1	1	0	0
Caribs	90	53	22	9	6								
For.-White	5	5											
Indians	0	0											
Chinese-I.	0	0											
East-Ind.	2	2											
W. I.-L. A.	3	1	1	1									
Total	2,027	821	461	398	179	93	42	16	7	5	3	1	1

TOTAL SPLEEN RATE AND MARKED SPLENOMEGALY BY RACES

	Number Examined	Total Spleen Rate		+1 or Larger Spleens, Rate	
		No.	%	No.	%
Latin-A.	3,896	1,714	(43.9)	1,092	(28.0)
West-Ind.	1,152	213	(18.5)	75	(6.5)
Caribs	328	90	(27.4)	37	(11.2)
For. White	99	5	(9.0)	0	(0.0)
Indians (Mountain Men)	11	0	(0.0)	0	(0.0)
Chinese-I.	5	0	(0.0)	0	(0.0)
East-Ind.	6	2	(33.3)	0	(0.0)
W. I.-L. A.	4	3	(75.0)	2	(50.0)
	5,501	2,027	(36.8)	1,206	(21.9)

A certain number of the people with enlarged spleens also had blood films positive for malaria parasites. I have determined the species incidence in the group for comparison with the general field incidence of malaria species.

Species	Species Rate Found With Enlarged Spleens %	Species Rate Found In Gen'l Field Survey %
Aestivo-autumnal	62.1	60.9
“ “ and tertian	4.2	3.8
“ “ and quartan	0.2	0.2
Tertian	29.9	31.1
Quartan	3.3	3.9

The following table is a comparison of three rates: The parasite rate, the spleen rate, and the combined rate. The last rate is obtained by including all persons who had a positive blood-film, a positive spleen, or those in whom both blood-film and spleen were positive.

THE COMPARATIVE RATES

Race	Number Examined	Parasite Rate		Spleen Rate		Combined Rate	
		No.	%	No.	%	No.	%
Latin-A., Lowland . . .	3,588	1,001	(27.9)	1,676	(46.7)	2,077	(57.9)
Latin-A., Highland . . .	308	25	(8.1)	38	(12.3)	57	(18.5)
West-Ind.	1,152	300	(26.0)	213	(18.5)	437	(37.9)
Caribs	328	134	(40.8)	90	(27.4)	171	(52.1)
For.-White	99	19	(19.2)	5	(9.0)	21	(21.2)
Indians	11	1	(9.1)	0	(0.0)	1	(9.1)
East-Ind.	6	1	(16.6)	2	(33.3)	2	(33.3)
Chinese-I.	5	1	(20.0)	0	(0.0)	1	(20.0)
W. I.-L. A.	4	1	(25.0)	3	(75.0)	3	(75.0)
	5,501	1,483	(26.9)	2,027	(36.8)	2,770	(50.3)

A consolidated summary of the rates, without regard to race, reveals the following:

49.6%	Negative blood and spleen
23.2%	“ “ “ positive spleen
13.5%	Positive blood and negative spleen
13.6%	“ “ “ positive “

LOWLAND (BANANA ZONE) AND HIGHLAND (COFFEE ZONE) RATES

	Number Examined	Parasite Rate (%)	Spleen Rate (%)	Combined Rate (%)
Lowland Adults	4,032	26.5	38.8	52.6
Highland Adults	112	7.1	15.1	20.1
Lowland Children.	1,161	33.2	36.4	50.9
Highland Children	196	8.6	10.7	17.3

It has been my impression that the personal factor is a source of greater error in the field application of the spleen index than it is in the application of the parasite index. The present survey gave me the opportunity to select experienced clinicians to determine the spleen index in the field. It is useless to consolidate all cases done by one man because race, age and residence are important features. I have therefore named the physicians A, B, C, etc., and will tabulate their results according to the races examined.

LATIN-AMERICANS (LOWLAND)

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	1,020	23.3	69.2
B	570	23.8	50.3
C and D*	869	41.8	37.0
E	154	29.9	47.4
F**	391	16.1	28.9
G**	297	14.1	24.9
H	199	21.6	32.6
I	85	24.7	38.8
J	3	0.0	33.3
	3,588	27.9	46.7

* The standing or sitting position was used here and the clothing was simply loosened over the region of the spleen.

** The division in which these groups were examined was under an active anti-malaria campaign.

LATIN-AMERICANS (HIGHLAND)

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	158	10.1	20.9
C and D	150	6.0	3.3
	308	8.1	12.3

WEST-INDIAN NEGROES (LOWLAND)

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	248	17.1	44.3
B	110	17.2	13.6
C and D	262	38.5	10.3
E	27	14.8	18.5
F	1	0.0	0.0
H	50	26.0	10.0
I	454	22.7	11.2
	1,152	26.0	18.5

CARIB (NEGRO) (LOWLAND)

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	112	45.5	45.5
B	80	56.2	18.7
E	22	27.2	18.1
J	114	28.0	17.5
	328	40.8	27.4

FOREIGN-WHITE (LOWLAND)

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	6	0.0	16.6
B	2	0.0	0.0
C and D	87	20.7	4.6
H	4	25.0	0.0
	99	19.2	9.0

CENTRAL-AMERICAN INDIANS
(MOUNTAIN MEN)

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
B	3	0.0	0.0
C and D	8	12.5	0.0
	11	9.1	0.0

EAST-INDIANS

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	6	16.6	33.3

CHINESE—CENT.-AMER. INDIAN MIXTURE

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
I	5	20.0	0.0

WEST-INDIAN NEGROES—LAT.-A. MIXTURE

Doctor	Number Examined	Parasite Rate (%)	Spleen Rate (%)
A	4	25.0	75.0

CONCLUDING REMARKS

I believe that these results are sufficient to show not only the influence of race on the spleen index, but also the difference that may be expected when a number of qualified doctors apply the same palpation methods in the field. The main difference found is in the group of spleens recorded as *barely palpable*; and in the series examined by Dr. A., a man of many years experience in hospital bedside work, sufficient time was used to get the patient in a satisfactory position (on the right side with the legs drawn up and abdomen well exposed) to perform deep palpation.

SUMMARY

- (1) These examinations were conducted on the mainland in seven different regions of Central America.

A small group of mountain people were included to offer some comparison with conditions found in the large group of coastal plain people.

The negroes included here showed many examples of marked race blending. They had lived for long periods under the same conditions as the Latin-American group, so far as exposure to malaria is concerned.

Men, women and children were more or less evenly apportioned in the groups examined. Experienced clinical physicians, except for Dr. B., determined the splenic index. The parasite index was made by the same thick-blood-film method used in the survey of the Haitian negroes.

- (2) The large, hard "ague cake" spleens were rarely found in the negro races and, when found, they were usually in individuals showing marked blending of races.

The *total spleen index* by races is as follows:

Latin-Americans	43.9% (including highland people)
West-Indian Negroes	18.5% (lowland, chiefly Jamaicans)
Carib Negroes	27.4% (lowland, African negroes).

The spleen rate, as it is ordinarily used in field surveys, would record only those spleens definitely felt below the costal margin on a deep inspiration. Including only those spleens that reached one or more fingers below the costal margin the resulting spleen index would be as follows:

Latin-Americans	28.0% (highland people included)
West-Indian Negroes	6.5% (lowland)
Carib Negroes	11.2% (lowland)

- (3) The incidence of aestivo-autumnal, tertian and quartan malaria found associated with enlarged spleens was practically the same as the general field incidence of the species.
- (4) The determination of the incidence of malaria, past or present, in a community can be more accurately made by employing both the parasite and spleen surveys.

Many cases of acute malaria will be missed if the spleen survey alone is employed. Note the following:

49.6% of the people examined had a negative blood-film and a non-palpable spleen.

23.2% revealed a negative blood-film and a palpable spleen.

13.5% showed a positive blood-film and a non-palpable spleen.

13.6% had a positive blood-film and a palpable spleen.

It will be noted that the parasite rate in all of my surveys on negroes is higher than the spleen rate, while conditions are reversed in the Latin-American race.

- (5) The comparison of the highland and lowland Latin-American groups offers considerable evidence that malaria is the chief cause of splenomegaly in our divisions. Where the parasite rate is low, the spleen rate shows a parallel decline in both adults and children.
- (6) The determination of the spleen index, under similar conditions, by ten doctors shows that the personal factor is an important one unless there is strict adherence to the field rule of recording only those spleens that are distinctly and easily palpable below the costal margin on deep inspiration.

LIST OF ABBREVIATIONS USED IN TABLES

Latin-A. —Latin-American

West-Ind. —West-Indian Negro (chiefly Jamaicans)

Caribs —Negro Descendants of African slaves

For.-White —Foreign-White people

Indians —Mountain-Indians, Central America

Chinese-I. —Mixture of Chinese and Mountain-Indians

East-Ind. —East-Indian (Hindu)

W. I.-L. A.—Mixture of West-Indian Negro and Latin-American

THE CONTROL OF MALARIA IN THE PRESTON DIVISION

P. S. MALARET, M.D.

United Fruit Company Hospital

Preston, Cuba

Preston's Climatic Conditions.—The Preston Division of the United Fruit Company, devoted to the cultivation of cane and the manufacture of sugar, is located on the north-eastern coast of the Island of Cuba, within the torrid zone, but possesses an equable, warm, tropical climate, with a medium annual temperature of 24°C. (75°F.). The highest summer temperatures oscillate between 30°C. (86°F.) and 36°C. (97°F.), and the lowest winter temperatures between 10°C. (50°F.) and 20°C. (68°F.). There are only very slight changes in the monthly curve from year to year, and the conditions are especially favorable for the endemicity and epidemicity of malaria.

Natural Water Collections.—The Division's cane-growing area, covering 106,987 acres, of which 54,611 acres are actually planted in cane, lies on a flat, coastal plain surrounding the Bay of Nipe. This area is plentifully supplied with water, having 1,144 acres in creeks, 2,587 acres in swamps, and 20 acres in lagoons, or a total natural water area of 3,751 acres. It is crossed by a number of rivers which rise in the Sierra de Nipe, of which the two most important are the Mayari and the Nipe. The others, little more than creeks, although perennially flowing, are the Juan Vicente, Guaro, Vitiri, Baguanos and Tacajo. In addition, there are a number of small creeks; and extensive mangrove swamps and marshes near the coast. In a few places, inland as well as near the coast, there are some lagoons which are difficult to drain. Seepage areas at many points where the land surface is uneven, and innumerable water pools which form in pastures following the rains, also add to the water surface.

Artificial Water Collections.—In addition to these natural water collections there are three main sources of artificial or man-made water collections to contend with, the most important of which is the supply for human and cattle consumption. From three dams located in the hills, near the sources of the Guaro, Sojo and Guayabo rivers, the water flows through a perfect system of pipes to all points of the Division. The excess water from the terminal pipes of this system gives rise to a large number of "water-faucet" drains. These drains, because of the purity of their water and their full exposure to the sunlight, are ideal breeding grounds for *Anopheles albimanus*, which is the only important vector of malaria in the region. This "excess" water presents a peculiar problem, for the reason that, while water accumulated directly from the rainfall tends to diminish progressively as the driest period of the year approaches, this type of "artificial" water flows continuously throughout the year. In consequence, it may be said that, because of our splendid water supply, we are subjected to a continuous rainy season in so far as mosquito-breeding is concerned. What this means in regard to the spread of malaria is self-evident.

Another type of artificial water-containers consists of the ditches,—those in the cane-fields that drain seepage water, and the sewer-drain ditches carrying water flowing from the camps toward the creeks. While the *Anopheles albimanus* is adverse to breeding in foul water such as is found at their sources in the last-mentioned drains, it breeds abundantly in them a few hundred feet below the sources after the water has become clarified.

The third type of artificial water-containers consists of the railroad borrow-pits, which retain water for a long time after the rains cease. Since the Division is criss-crossed with railroad lines to connect the several points with the mill at Preston, these borrow-pits were numerous up to recently.

Rainfall Data.—The rainfall is abundant, the mean annual precipitation for the last 10-year period being 45.04 inches. Definite dry and wet seasons are not the rule. However, a study of the rainfall for the last 10-year period and for the years 1924–1928, inclusive, shows that the wettest period is in the month

of May, with a secondary heavy period in the months of October–November. The driest period of the year seems to be in March–February, and the rainfall for the other months oscillates between these two extremes. Herewith is the last 10-year average, by months:

Month	Inches
January	3.58
February	2.05
March	1.26
April	2.88
May	7.82
June	3.59
July	2.25
August	2.63
September	4.26
October	5.34
November	6.07
December	3.31

Because of other factors that demand attention, no attempt has been made to correlate precipitation with anopheline production and malaria incidence. As the work progresses, knowledge of this factor may be considered as economically important.

Factors Influencing Population.—The population of the area has varied considerably in past years from a peak in the “crop season,” when the cane is harvested and manufactured into sugar, to the lowest number in the “dead season,” when temporary laborers, who have come in for cane-cutting only, return to their homes. The “crop season” usually extends from January to April, May, or June, and the dead season for the remainder of the year.

During “crop” months the population, although variable, may reach 18,000. Following the termination of the crop some 6,000 may leave the Division, so that there is a stable population of approximately 12,000 persons. These are scattered throughout the Division in 6 villages, 22 farm “bateys” (administrative centers) and a number of camps. For the purposes of our study, however, the Division may be divided into 2 main areas: the village of Preston with its mill and Division headquarters, and the agricultural area.

Agricultural Area Described.—The agricultural area, with which we are mainly concerned, has its headquarters in the village of Guaro and is divided for administrative purposes into 4 districts with 22 farms and a Live-stock Department. Within it are 5 clusters of houses, sufficiently large to be called villages—named Juan Vicente, Guaro, Santa Isabel, Buenaventura and Herrera; 22 farm bateys; about 200 camps; and a number of isolated houses. The villages vary in population from a few hundred (Santa Isabel) to nearly 1,000 (Guaro). The camps are scattered on the farms between one farm batey and another. Most of them are empty during the dead season, although people live continuously in some of them. Beyond the cane area, in the hills, there are many scattered houses

belonging to so-called "squatters," who cultivate small parcels of land and who work as laborers on the farms.

General Health Conditions in the Division.—Except for malaria, conditions are not bad. It has always been the policy of the Company to attempt the control of infectious and epidemic diseases. In so far as malaria is concerned, the results have been meager until now, and this may be attributed to previous lack of proper direction rather than to passive acquiescence in the conditions. Respiratory and skin affections are widespread, as might be expected under the living conditions of the majority of the people. Other infectious diseases could not extend widely unless imported by large numbers of incoming laborers. Splendid milk and water supplies successfully keep in check enteric affections such as typhoid, the dysenteries, etc. The lack of moist, shaded areas such as are found on coffee plantations, and a penetrating sunlight, take care of hookworm disease. A sufficiency of green food-stuffs and vegetables supplied by Company gardens and nearby squatters on Company land, prevent deficiency diseases. Lues is fairly common, although not inordinately so. A few cases of tuberculosis and cancer come to the attention of the Medical Staff yearly. In short, barring common human ailments and surgical conditions, the Division once malaria is effectively controlled, should be able to present an enviable health record.

Control Conditions Prior to the Campaign.—The campaign we are about to describe may be said to have begun in the month of December, 1925. At the beginning the efforts made were rather feeble, the sole moving force being the local Medical Department. A few months later the general Medical Department began its intensive drive in all the Company divisions and the local efforts derived considerable strength therefrom. As the work has progressed, the local authorities have become more enthusiastic over the results obtained, and greater latitude has been allowed our activities. Prior to the date mentioned above, the control of malaria in the Division was in the hands of a Division Sanitary Inspector and 3 quinine-distributors who covered each of the 4 districts on horseback in an attempt to distribute quinine on a prophylactic basis, administering the drug to all those who could be induced to take it, mainly the laborers in camps. No attempt was made to cover the native families in the bateys and villages. The quinine was administered in solution, and this was mixed with rum in an effort to make it more palatable and as an inducement to the men to take it.

Notwithstanding the use of these measures, in December 1925 malaria was raging throughout the Division. Exactly how much there was before this time, we do not know. Local death records are at best very unreliable, and we doubt whether the time that could be spent in their study would be fruitful. We do know, however, that at least 50% of the admissions to the Company Hospital were for malaria; also, that at various points in the Division blackwater fever cases were of frequent occurrence, and this in our opinion is a fair index of the prevalence of malaria infection. A region where cases of blackwater fever occur

must necessarily be an intensely malarial region. The best index, however, was our personal experience and the First Blood Survey made by Dr. H. C. Clark, Pathologist, of the general Medical Department. We found an enormous number of infected persons in our daily work, a great many of whom were very heavily infected, as evidenced by the blood examination. Dr. Clark in this First Survey, made in May 1926, found that 55.9% of the persons examined harbored malaria parasites.

Labor Migrations Apparently an Important Factor.—In efforts to control malaria the labor migrations seem to be of importance. The sugar-industry labor requirements vary markedly throughout the year. During the crop, when the cane is being cut and manufactured into sugar, a large labor force is necessary. When the crop is over and the dead season sets in, little labor is needed. As a result, the labor population of the Division varies greatly, and this labor migration, when the working force increases, must necessarily affect the malaria curve. This indeed has been found to be the case. The crop begins in the last days of December, when the recruited labor pours into the Division and a large number of the workers are infected with malaria. By the month of March, which happens to be the driest month of the year, the peak in the number of cases is reached. From March the cases begin to diminish, and the decrease continues until the end of the crop, when the exodus begins. Following the departure of the imported labor a rise in the curve in the settled population is noticed, year after year, which soon declines until toward November and December when a small rise is again evident. Whether to explain these variations in the curve on the basis of meteorology and mosquito bionomics, or of labor migrations, it is not possible to say at this moment; but we may say that the labor flux seems to be the important factor.

The Malaria Vector.—Malaria is transmitted by anopheline mosquitoes, of which there are some 100 different species. Some of these are potent malaria-carriers, while others are of minor importance. In this Division, as in most of the American Caribbean countries, we are unfortunate in having as our carrier one of the hardest of all, the *Anopheles albimanus*. There are 3 other species of *Anopheles* that have been found in Cuba,—*vestitipennis*, *grahami*, and *crucians*,—but in our Division they must be very rare, as the *albimanus* is the one species that is constantly found.

Anopheles albimanus is capable of very long flights in search of blood, so that work directed toward its control should logically be extended quite a distance from habitations. However, our work has been limited to short-radius control of breeding grounds, and notwithstanding such limitation the results have been fruitful.

During daytime the adult anopheline mosquito is hard to find, and although it may occasionally be seen in human habitations, it apparently prefers the cane-fields for resting during the day, and visits human habitations only at night for blood-feeding purposes. It prefers to lay its eggs and breed in clear water; and

slowly flowing rivers, streams and creeks, with algae mats on the surface which protect the larvae from the fish are favorable places. But the ideal breeding place for *A. albimani* is a water-faucet draining ditch, well-exposed to the sunlight, with not too much water, and with some grass on the edges. Here they can be found in large numbers. Indeed, small pools of rain water anywhere are prolific sources of mosquito breeding.

The Problem, and the Control-campaign Plan.—The problem that presented itself to us, then, was that of a large area, producing a crop which requires a climate and an environment favorable to the breeding of the malaria-carrying mosquitoes that prevail in the area; and a migrating population which prevented thorough inspection and treatment the year round. Moreover, the population was largely composed of uneducated individuals who could not be expected to help themselves; for whom everything had to be done; who were heavily infected with malaria, (as evidenced by the First Survey of Dr. Clark, which showed that 55.9% were infected); and in whom there was a considerable incidence of blackwater fever cases. It was obvious that malaria was primarily responsible for the high morbidity rate in the Division, and that the labor output must necessarily be low because of the high morbidity. It was a situation which could not be for the best interests of the Company.

Under these circumstances, in December 1925 a discussion with the Superintendent of Agriculture, whose Department was most interested in the work, revealed the fact that there was great unrest among the labor force because of the high incidence of disease, and that the quinine distribution as then being carried out did not seem to be of great assistance. It was therefore decided to try out a new plan radically opposed to that which was then in operation. In the first place, quinine would be administered not prophylactically but for active treatment only. In recent years it had been the growing conviction of malariologists that prophylactic quinine was not as valuable as it had been previously considered, and this belief was further confirmed by the experience of the English in Mesopotamia during the World War. Because of the large area, it was realized that a veritable army of quinine-distributors would be necessary during the crop season to cover properly all the camps; and since the Agricultural Department had a well-disciplined and intelligent organization, keenly interested in the problem of malaria because it affected their work, it was decided to entrust the administration of quinine to the farm personnel. The quinine was supplied by the Medical Department in tablet form (5-grain tablets) and distributed through the District Superintendents to the Farm Overseers, who had direct charge of its administration to all persons on the farms who became ill and whose symptoms caused strong suspicion of the illness being caused by malaria. All cases with serious illness and those that did not respond promptly to quinine were referred to the Medical Department. This plan of administration has worked so well that after 3 years of thorough trial no thought of changing it has been suggested. By this method approximately 300,000

tablets of quinine have been distributed yearly, and the results as they affect the number of admissions of cases to the Hospital, and the labor output per man, have been little short of marvelous, as will be evident when we discuss the accomplishment to date.

This quinine was administered in tablet form because of the greater ease in handling and transporting it in this way. Moreover, the clinical experience shows that the results are equally as effective as with the liquid form. Farm Overseers were carefully coached as to the methods of administration and advised to give all adults who complained of "fevers" 2 5-grain tablets 3 times a day until all symptoms had subsided, when the dose would be reduced to 2 daily for as long a period as possible up to 2 months. Children have from the beginning continued to be treated by the Field Medical Officer stationed at Guaro, since a layman could not be expected to form an opinion as to the nature of disease in infants.

Few Quinine Injections.—A noteworthy fact is the sparse use of quinine injections during this period of three years. While, at the beginning, the clamor for injections of any kind was great, and the aversion to quinine if administered by mouth was general, as time went by the people were gradually convinced of the truth of our statements that injections were not the best routine method of treatment, and that quinine was the only specific for malarial fevers. The fact that we made a diagnosis of malaria only after a blood smear had been examined, was a powerful factor in convincing the people that we did not make this diagnosis capriciously, and their confidence in our methods of procedure was thus largely won.

Recording the Quinine Administered.—A record of the quinine administered was kept not only by a careful check of the quinine issued to district officers, but also by quinine reports which the Overseers were asked to submit weekly, and in which they noted the number of persons living at each camp and batey, the number sick day after day, and the number daily given quinine. These reports serve a double purpose; they not only keep the District Medical Officer informed as to the prevalence of fevers in each area, but they also serve to remind the farm personnel that among their duties are the care of the sick and the distribution of quinine.

Field Malaria Inspector's Rôle.—A great help in finding cases that were suffering from malaria, so that they could be treated and cured, thus preventing their becoming carriers of the disease, was the appointment of Field Malaria Inspectors whose duty was to visit some portion of the Division each day. They called at each house and filled out a card, termed the House Inspection Card on which a report is made of the health conditions of each family. If they found any cases of "fever" or cases complaining of any symptom suspicious of malaria, a thick-blood film was taken and was examined at the Guaro Dispensary. All cases found positive were reported to the District Superintendent, who, in turn, advised the Farm Overseer, with the request that quinine treatment be insti-

tuted for as long as possible up to a period of 2 months. The responsibility of the Malaria Inspector does not end here, as he is expected to look up these cases at each subsequent visit and make sure that they are taking quinine. Besides this purely anti-malaria work, the Inspector gives treatment for all minor ailments and reports to the Doctor any cases which appear to him suspicious of being a serious illness. On the reverse side of this card information as to the sanitary conditions of the surroundings is noted.

Plasmochin and Quinine.—We have purposely not previously mentioned the use of plasmochin compound tablets in our work. The degree of this drug's toxicity was not clear in our minds before the publication of the 1927 Annual Report of the Medical Department of the Company. The peculiarity of our labor problem during these 3 years, different from that of the other divisions, was that Haitian immigrant labor was imported every year for the period of the crop and returned home at the end of the season, and no close medical supervision was possible, nor could we expect from such persons the proper cooperation in using the drugs supplied. These conditions prevented us from distributing plasmochin on a wholesale basis from the moment this drug was first put on the market, and limited our treatment by plasmochin to hospital cases and cases that could attend the dispensaries regularly. During the last 6 months, however, we have been using plasmochin in all cases of malaria we can reach, having employed 10,000 plasmochin tablets in the Division from September, 1928, to date (end of February, 1929). Of these, 2,000 have been used by the Hospital and 8,000 in the field. As our standard plasmochin treatment is 20 tablets per person, to be taken in 5 days, or 4 a day, this means that we have administered 400 plasmochin treatments during the period mentioned. As time goes on, there is no question but that we shall increase our plasmochin treatments, as reports continue to come in regarding the efficiency and safety of this drug if properly handled. Plasmochin acts chiefly on the sexual forms of the parasite which infect mosquitoes, while quinine is curative inasmuch as it acts chiefly on the asexual forms which give rise to fever in the human host. A combination of the two drugs will probably furnish the ideal specific that will sound the death knell of malaria. But plasmochin is a new drug, and it still has to prove its full worth, although the experience of the Medical Department of the United Fruit Company and other workers would seem to indicate that it will be of great value in controlling malaria.

The Big Problem of Prevention.—If we can not at this date attempt a wholesale cure of all infected cases in a given community, and thus prevent mosquitoes from getting infected, we can at least protect ourselves from the bites of mosquitoes. But this is more difficult as a wholesale measure. Mosquitoes will breed where there is a suggestion of water, and we can not do without water in agricultural pursuits. Consequently, in attempting to prevent breeding in extensive sections, we are faced with an expensive proposition.

Looked at in this frank manner the problem seems hopeless, but it is not. In

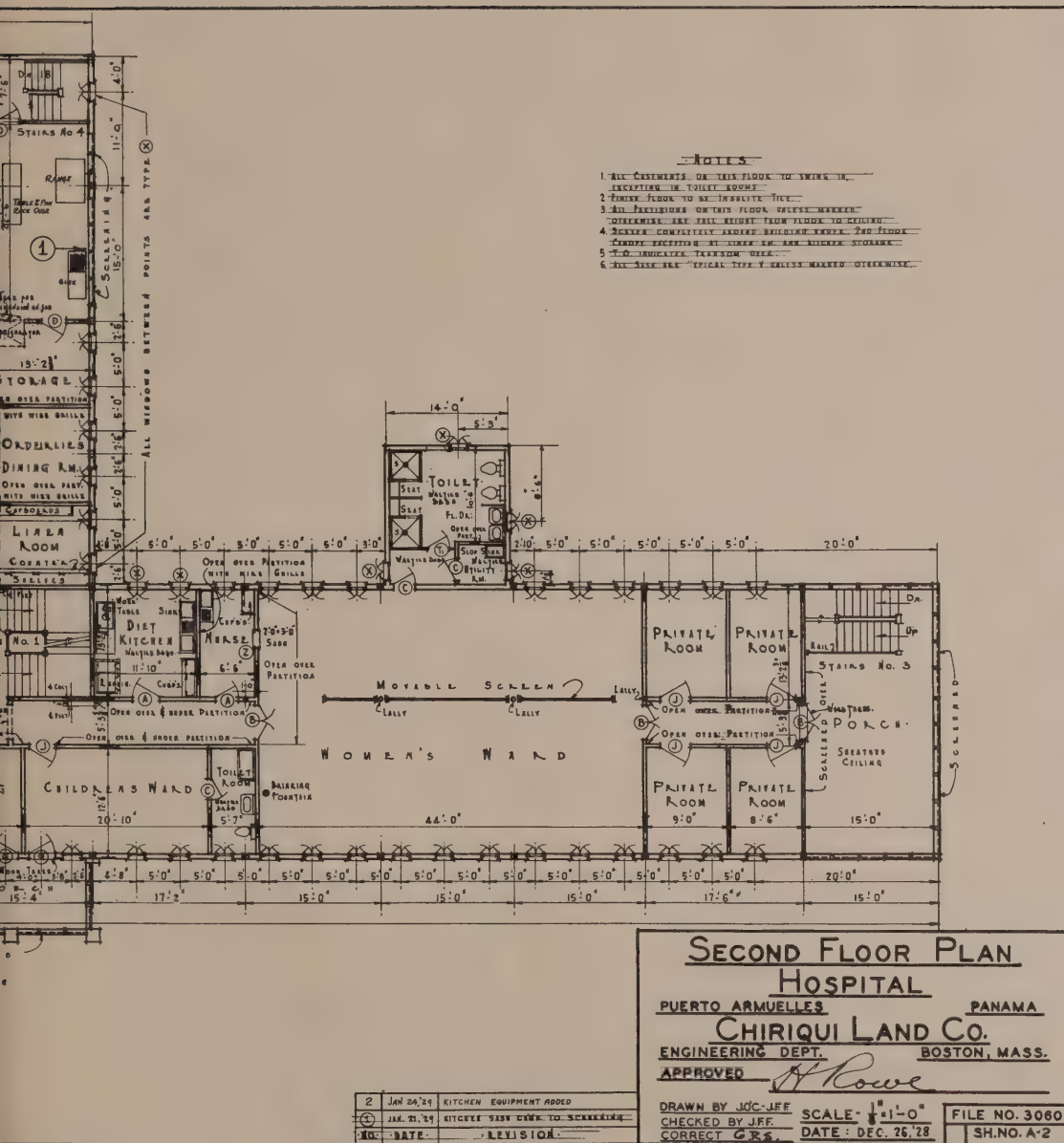
the following section we shall try to recount the story of the work that has been done in the Preston Division in the last three years and show what tremendous reduction has taken place there in the incidence of the disease, as a result of the application of control measures and coordinated effort. It will be seen that the solution of the problem in that Division is, simply: To cure the largest possible number of cases; and to prevent breeding in the largest possible amount of water, in order that the anopheline-mosquito population may be reduced to a minimum. As time passes, the "largest possible number of cases" to be cured will become fewer, and the "largest possible amount of water" to be controlled will be lessened.

While the Field Dispensary in Guaro, the Farm Overseers and the Hospital Staff took care of the active treatment of all infected cases of malaria, a means had to be found to exercise some measure of control of the breeding of anopheline mosquitoes.

A plan was evolved which also has stood the test of three years' work, and which bids fair to continue without change in its major aspects. The adult mosquito was purposely disregarded, as it did not seem profitable to attack the problem from this angle. The attack was to be concentrated on the larval stage of the mosquito; and this means (1) direct destruction of larvae by the use of larvicides, and (2) indirect prevention of breeding by curtailment of the water breeding-areas of the Division. The first was a temporary measure of which immediate results were expected. The second, a measure of a permanent character, could not be expected to yield far-reaching results, although it would improve local areas. It will take some time before sufficient water-area has been permanently controlled to affect the mosquito index of the whole Division.

Permanently Reducing the Water Area.—The permanent reduction in the water area has consisted mainly in the filling in of railroad borrow-pits, the draining of small lagoons, the cleaning of small creeks and ditches, attention to seepage water, etc. This work has been done by the various departments in their respective zones of influence, at their own discretion or at the request of the Medical Department. The amount of this kind of work that has been done in three years has been very satisfactory. It is being carried forward slowly; but it proceeds steadily, and that this is so can be attributed only to the spirit of cooperation which pervades all departments of the Division. The Railroad Department has been zealously pursuing the abolition of borrow-pits, which should disappear altogether within a short time. The Engineering Department, by relocating innumerable water faucets so that they will drain directly into creeks, and by eliminating a very large number of unnecessary faucets, has doubtless considerably reduced the number of mosquito-breeding areas. The Agricultural Department's efforts to keep creeks and ditches clean has been a strong contributing factor in the reduction of the mosquito index.

Anti-larva Campaign.—The anti-larva measures consisted, in the beginning, of the use of oil around villages, but very little around camps and bateys because



ORIGINAL BLUEPRINTS, AND SCALES SHOWN MUST BE MODIFIED ACCORDINGLY

of the difficulties attendant upon its handling. At the beginning of 1927 we were visited by Dr. M. A. Barber, of the U. S. P. H. S., who gave us clear-cut demonstrations of the advantages to be derived from the use of Paris green as a larvicide. Paris green has been of immense advantage in our work. Easily handled, it renders the treatment of widely extended areas a simple problem.

In our work we began by using a mixture of Paris green and road-dust in the proportion of 1 to 100. Later on, as the work progressed and we gained in experience, we found that we could increase our dilution to 1:150 or even 1:200, according to circumstances. A great improvement was made, we thought, in the idea evolved by the Guaro Sanitary Squad of using sawdust instead of ashes or road-dust, etc., for the mixture, as the sawdust, because of its lightness, helps to keep the Paris-green particles afloat,—a thing much to be desired, as the basic idea behind the use of Paris green is that its particles will float on the surface of the water, where they are ingested by the anopheline larvae, which are surface feeders.

For the application of the Paris-green dust mixture we separated the Division into 2 areas to be treated by 2 anti-mosquito squads, 1 operating from Preston in charge of the Medical Department Sanitary Inspector, and 1 from Guaro in charge of the Agricultural Department Sanitary Inspector. It was found that these squads could cover their respective areas in a period of 10 days. Later on, because of the reduction in the number of breeding foci near habitations, it was decided to give 3 districts to the Guaro squad for Paris-green treatment and 1 district only to the Preston squad, which was to apply Paris green and to do as much ditching, filling of holes, etc., as possible. It is hoped that eventually this second squad will travel throughout the Division, spending more time in its area and doing more and more permanent work while the first squad is devoted to Paris-green and oil applications exclusively.

SUMMARY OF RESULTS

This is the program which the Preston Division has been trying to follow for the last three years, and which it expects to complete in years to come:

First, the discovery and treatment of every case of malaria occurring in the Division so as to reduce to a minimum the number of malaria-carriers.

Second, the treatment of mosquito-breeding areas near habitations, reaching as far out as conditions permit.

Third, the elimination of water collections so far as possible or practicable.

What, then, have been the results obtained to date?

In the year 1925—which the writer spent in the Preston Hospital—in accordance with tradition and past experience, once the beginning of the crop season drew near, all decks were cleared for action in the Hospital, because of the repeated inrush of patients, which generally increased week by week and became so great that all available space had to be placed in readiness. Altogether 1,038 cases of malaria were admitted to the Hospital in the year 1926, the first

year that the work was carried on; 671 cases were admitted in 1927; and 246 cases in 1928. These admissions, by months, were as follows:

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1926	107	127	272	135	113	88	76	32	21	15	18	34	1,038
1927	59	178	279	92	22	13	6	10	3	1	5	3	671
1928	14	33	92	27	26	20	9	4	4	5	6	6	246

What these hospital cases represent in total malaria in the Division we had no means of knowing until this year, 1928, as we did not have a Field Malaria Inspector at the beginning of the campaign and no tally was kept of the out-patient cases of the disease. Such a tally has been kept this year, however, and we find that outside the Hospital 1,217 cases of malaria were treated, which, added to the 246 cases admitted to the Hospital, make a total of 1,463 cases of malaria treated during the year or, roughly, 12%, if the population is figured as 12,000. In this number of cases many relapses in primary infections and in chronic cases are included, so that the same case of malaria may appear more than once. We must also observe that we believe not very many cases occurred this year without being recorded and treated, and that these figures are fairly close approximations of the actual number of cases that occurred. These out-patient cases occurred, by months, as follows:

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1928	78	122	262	251	71	75	105	57	28	25	53	90	1,217

A comparison of the percentage of malaria cases admitted to the Hospital, in relation to the total admissions, shows that while 38% of the cases admitted in 1926 were malaria, there were only 28% in 1927, and 13% in 1928.

An even more suggestive proof of the reduction of malaria in the Division is seen in a comparison of the various blood surveys made in the 3 years. While in May, 1926, the original survey made by Dr. H. C. Clark showed an infection percentage of 55.9 of the total population, a survey made at the same period of the year in 1927 showed that only 24.2% of the population were infected, and the survey made about this same period in 1928 showed a percentage of infection of 8.78.

These are very imposing figures, and they denote that much suffering must have been prevented; but if we look at the death rates for the 3 years under study even more gratifying results are observed.

While in 1926 there were 131 deaths from all causes and 44 from malaria; in 1927 the deaths dropped to 103 from all causes and 10 from malaria; and in 1928 there were 102 deaths from all causes and 10 from malaria. These deaths may be tabulated as follows:

Year	Hospital		Out-Patient		Grand Total	
	Total Deaths Due to All Causes	Malaria	Total Deaths Due to All Causes	Malaria	Total Deaths Due to All Causes	Malaria
1926	90	29	41	15	131	44
1927	72	6	31	4	104	10
1928	60	3	42	7	102	10

In order to explain the increase in out-patient deaths, both total and malaria, and the slight decrease in total deaths in 1928, we record below the number of treatments at the Guaro Out-Patient Dispensary, showing a great increase in the number of treatments given in 1928 as compared with 1927. This increase in numbers is due to a positive increase in population, and a more careful search for malaria cases, during 1928.

	Guaro Out-Patient Dispensary		Malaria Percentage of Total Treatments
	Total Treatments	Malaria Treatments	
1926	7,823	2,469	31.56
1927	6,736	1,307	19.50
1928	9,860	1,822	18.47

The figures quoted show the results of the work as it affects the health of the labor population of the Division. And, although this is of the greatest importance; there is one other factor which we mentioned at the beginning and which is worthy of special comment. We said that the reason why malaria is of great importance to the employer of labor is that it produces a debilitating effect on the labor force, and that it is economically a paying proposition to diminish the incidence of malaria. I believe that this is well-proved by the increase in the tonnage of cane cut per day per man during these years. These figures are as follows:

	Tons Cut per Day per Man
1924	.961
1925	.980
1926	.936
1927	1.233
1928	1.393

This simply means that, as years go by, a smaller number of laborers will be required to handle the seasonal crop; and that there will be a consequent reduction in expenditure for labor and a diminution in the cost of production.

PROGRAM OF MALARIA-CONTROL

W. E. DEEKS, M.D.

Malaria continues to be our most important disease, when considered from the standpoints of morbidity and the effects of malaria on labor efficiency.

As a result of the intensive anti-malaria campaign inaugurated about three years ago, considerable progress has been made in controlling its incidence and in mitigating its effects on the efficiency of labor. A brief report of the manner in which the work is being carried on and of the results obtained, is herewith submitted.

Malaria-control measures must be considered from 2 standpoints:—(1) the prevention of mosquito-breeding; and (2) the cure of the "carrier."

MOSQUITO-BREEDING PREVENTION

In regard to the first, the plantations of the United Fruit Company are located mainly on the coastal plains of the American Tropics. The altitude is low, the rainfall abundant, and the temperatures are favorable to the development of mosquitoes throughout the year. Moreover, the chief vector is *Anopheles albimanus*, which is capable of a flight of two or more miles.

Short-radius Control.—Under these conditions, to attempt to control malaria by the prevention of mosquito-breeding alone in the extensive areas under cultivation (over 700 square miles), even if practicable, would involve expenditures that no commercial organization would sanction. Our efforts to prevent mosquito-breeding, therefore, have been limited to short-radius areas around habitations, with the object of reducing the number of *Anopheles* within short-distance flight.

It has been demonstrated by careful sanitary surveys that in the sugar plantations about 75% of the breeding foci within flight-range of habitations are man-made in character; while on the banana plantations, about 40% are of that nature.

Many of these can be, and are being, gradually eliminated with modest expenditures. Discarded cans, bottles, and similar rubbish are destroyed; water-containers for drinking purposes are screened; water surfaces that readily and economically admit of drainage or filling, are eliminated, and in cases where this is not possible mosquito-breeding is controlled by weekly applications of Paris-green mixtures (1 part to 100 of road-dust or sawdust) or in certain locations by some preparation of crude oil, both of which are prepared at a central plant. The grass is periodically cut around habitations, and the immediate surroundings are maintained in a state of sanitary cleanliness.

Drag-line ditches designed to drain extensive swampy areas for agricultural purposes, have been the means of obtaining brilliant results—districts hitherto highly infected, have become comparatively healthy.

Anti-larva Sanitary Program.—In order to make the antilarva measures effective, two men specially trained in sanitation are employed to periodically visit the divisions, thoroughly inspect all inhabited districts for mosquito-breeding foci, and initiate measures for their control.

In each division one or two local Sanitary Inspectors, with a sufficient gang of laborers, do the routine follow-up work of inspection and institute the corrective measures necessary to remedy minor insanitary conditions.

If any sanitary recommendation necessitates large expenditures for draining, filling, and so on, the program becomes a problem for the Manager to decide upon and the Engineering Department to undertake.

Two methods are followed, to carry out the routine sanitary work:

The one is to utilize a motor-car sanitary gang in charge of the local Sanitary Inspector, which covers the Division once a week distributing the Paris-green or oil mixtures.

The other method is to have the Farm Superintendent or other department head designate some subordinate employee in his respective department to distribute the larvicide which is furnished to him by the Sanitary Inspector, with proper directions for its use. Under most conditions, the latter method is cheaper when a proper organization can be effected.

Some of the camps, however, are near swamps or other extensive breeding areas that do not admit of control by the measures outlined above. We are of the opinion that under these conditions the only reliable measure to protect the inhabitants consists in the screening of houses. But if we are to make this effective in the labor habitations, we are faced with serious difficulties. It has been found that many illiterate laborers resent the institution of this measure and will destroy the screens, leave the doors and windows open, and refuse to take advantage of the protection afforded during the hours of the mosquito flight. Only a slow process of education will correct this mental attitude.

In some of the divisions the inside of houses has been whitewashed, in order to discourage the adult mosquitoes from resting within during the daytime. The result has proved to be distinctly advantageous, and also has been appreciated by the house-dwellers, who eagerly cooperate in the destruction of mosquitoes by insecticide sprays.

Sanitary Work Summarized.—In brief, the sanitary work aims at:

- (1) Elimination of mosquito-breeding foci within short-radius areas around habitations
- (2) When this measure is not practicable, weekly applications of Paris-green dust or crude-oil mixtures
- (3) The maintenance of camps in a state of sanitary cleanliness
- (4) Whitewashing of houses on the inside, and destruction of adult mosquitoes
- (5) Under special conditions, the screening of houses. This is a routine measure among all the American and European employees and those locally employed in executive positions, as this class of employee will cooperate in screen maintenance.

THE CURE OF THE CARRIER

Race, Tolerance and Incidence.—The laboring population consists chiefly of negroes, native Indians, and mixtures of these and the white races.

There seems little doubt that the negro race has been exposed longer to malaria than the Indian or the white race, and in consequence has developed a higher tolerance to it than either of the others. In the negro, the average splenic enlargement, as well as the incidence of blackwater fever, is much less. The splenic enlargement in cases of malaria in the different races has been the subject of an extensive study by Dr. H. C. Clark. In the 1927 Annual Medical Report one of his investigations was published, and a second appears on page 77 of the present Annual Report.

The blackwater incidence in different races in the Canal Zone during the construction period was the subject of an extensive report by Dr. W. M. James and the writer, in 1911. The low incidence of blackwater fever among the negro race as compared to other races was clearly shown.

That the negro race has a high degree of tolerance to malaria, even the E. A. type, is generally understood by malariologists, and is further evidenced by the work of Dr. Neumann, as reported on page 118 of this Annual Report. The race question, therefore, can not be ignored in efforts to cure the "carrier."

On the coastal plains where the United Fruit Company's plantations are situated, the conclusion is inevitable that the whole labor population resident there for one or more years, has had or now has malaria infection. Some individuals, particularly among the negroes, have developed such a high tolerance to the disease that they have become comparatively immune. The blood is usually free from parasites, nor will such individuals develop symptoms through intravenous injections of highly-infected blood. Even if parasites are found after the injections, they are only temporarily present and disappear either spontaneously or following small doses of quinine.

Other individuals carry parasites in their blood for months, and even years, apparently without sacrificing much of their labor-efficiency. If, however, their resistance becomes lowered by some depressing influence—exposure, fatigue, injury, intercurrent infection, etc.—an acute exacerbation of symptoms occurs and the blood swarms with parasites. Under this relapsing condition, such persons are liable to become reservoirs of prolific infection to mosquitoes and a menace to the community.

Causes of Endemicity.—With the exception of infants and newcomers from non-infected districts, in whom primary infections are encountered, the vast majority of malaria cases we are called upon to treat are either relapses or super-added infections occurring in highly malarious communities. In almost all chronic cases who suffer from a relapse, or have an acute exacerbation of symptoms, convalescence rapidly ensues following rest in bed, a purgative, and short courses of quinine; but these measures do not necessarily establish cures. They merely enable the patient to resume the daily task with no more discomfort than he experienced before the relapse. As long as chronic "carriers" exist in a community and there is prolific breeding of mosquitoes, malaria will remain endemic.

The Principal Aim: Early Treatment.—The main object of the present campaign is to treat malaria cases early in the course of an acute attack of either a primary infection or a relapse. To do this necessitates a daily inspection of all labor units and their families, and the institution of immediate treatment. It is apparent that any special organization that would be able to accomplish such a task unaided would necessitate a very large personnel, as the work would entail a daily visit to over 50,000 laborers and their families.

How the System Operates.—To make possible the performance of the task, the

cooperation of every intelligent organization unit on the plantations of the United Fruit Company has been enlisted—the Division Manager, Heads of Departments and their subordinates, down to the Overseers, Timekeepers and Foremen. The responsibility of visiting the laborers and their families rests, in the final analysis, on the Overseers, Timekeepers and Foremen who are immediately in charge of labor units. If any laborer does not report for duty, his quarters are visited; and if he is found suffering from fever, treatment is immediately given. In the surveys, it has been found that about 90% of the cases of illness which keep laborers from work is caused by malaria, except under such conditions as epidemics of influenza. Most of the other illnesses encountered are of minor importance—such as slight digestive disturbances, and the like. All cases that appear serious, or that do not yield promptly to treatment, are referred to the dispensaries or hospitals.

Drugs and Dosage.—The question naturally arises as to the nature of the drugs whose administration can be safely entrusted to laymen. In addition to first-aid kits, the units in charge of labor are provided with epsom salts, compound cathartic pills, 5-grain quinine sulphate tablets, pink tonic tablets* and compound plasmochin tablets (plasmochin .01 gm. and quinine sulphate .125 gm.).

If a laborer is found to be suffering from fever, he is given a purgative and 3 quinine tablets morning and night. When the fever abates, he is given 2 pink tonic tablets 3 times daily, or 3 twice daily, over a period of from 2 to 3 weeks or more. It has been proved that the laborers prefer these to quinine and return for them again and again.

Plasmochin and Ring-forms.—When plasmochin was first introduced, it was found that in the dosage recommended by its sponsors certain untoward results developed, which at times proved serious or even fatal in character. It was considered that, although the drug was of great value in ridding the blood of gametocytes, yet it could be safely administered only when the patients were in hospitals under daily medical supervision.

Most of the clinicians experienced in the use of the drug are of the opinion that it has some value in ridding the blood of the ring forms of the benign types of the parasite. But we must consider that in relapsing cases almost any measure which will improve the resistance of the patient will bring about a favorable result, and in consequence we may at times reach unwarranted conclusions as to the benefits to be derived from so-called specific remedies when given under these conditions. In any event it has been our experience that plasmochin exerts little or no action on the ring forms of the E. A. type; and in many cases, in the early days of its use, we were forced to resort to the salts of quinine in order to save life.

Plasmochin and Gametocytes.—On the other hand, against the gametocytes of all types of malaria the drug has a specific action. It has been repeatedly

* Formula: quinine sulphate 2 gr., arsenous acid 1-50 gr., ext. nux vomica 1-8 gr., reduced iron 3-4 gr.

demonstrated that 4 to 6 of the compound tablets (plasmochin .01 gram and quinine .125 gram) administered daily in divided doses, will rid the peripheral blood of gametocytes within from 2 to 6 days. Rarely have they been observed as late as the 8th or 10th day. These results are not obtained by the administration of quinine alone, as E. A. gametocytes have been found in the peripheral blood following the administration of 40 grains of quinine sulphate daily over a period of 40 days or more. In fact, in acute attacks of malaria treated with large doses of quinine over short periods, many cases show more gametocytes in the peripheral blood at the end of the treatment than at the beginning.*

Investigations Regarding Plasmochin.—The above material summarizes the clinical knowledge and the methods of administration of plasmochin up to January, 1928. At that time Dr. M. A. Barber and Mr. W. H. W. Komp, both of the U. S. Public Health Service, carried on investigations in the Panama Division of the United Fruit Company regarding the effects of plasmochin on the gametocytes, as determined by their subsequent infectiveness to mosquitoes. The results of these investigations also were given in our Sixteenth Annual Medical Report, 1927. They showed that mosquitoes fed on highly infected patients (3, E. A.; and 1, T.) who had taken plasmochin in combination with quinine for 1 or 2 days, failed to develop oocysts.

Recently, similar investigations were carried out by Dr. Barber and Mr. Komp (December, 1928, to February, 1929) but with smaller dosage, and the same results were obtained. The detailed report appears on page 34 of the present Annual Report. It was found that a single compound plasmochin tablet, or even one-half of one, produced the same results as the larger dosage given the previous year, and that its effects continued over the period of an acute febrile attack. Dr. Barber, as noted in his report, is of the opinion that 1 tablet (plasmochin .01 gram and quinine .125 gram) will prevent mosquito infection; and that, in any event, this dosage need be repeated only once, after an interval of 3 or 4 days. He found that, although the gametes exflagellated in the stomach of the mosquito, no oocysts developed. In control cases with or without quinine administration, infection invariably occurred. These investigations, if subsequently confirmed by others, will have clearly demonstrated the value of plasmochin, and they will have shown that more of the drug has been given than is necessary to obtain satisfactory results.

In the small dosage mentioned just above, the drug can be administered safely to any individual once a week; and it requires only the full cooperation of every intelligent unit in any organization to make it effective in preventing mosquito infection.

Colonel S. P. James has demonstrated that a mosquito, once infected, can continue to transmit infection over a period of 3 months. If a compound plasmochin tablet could be administered once a week to every inhabitant in a

* See "Plasmochin in Malaria," by O. T. Brosius, M.D., *Sixteenth An. Rept.*, 1927, Med. Dept., United Fruit Co., p. 26.

community during a three-months period, the probabilities are that none or only a few infected mosquitoes would survive. After this manner complete control of an area could be expected, provided there were no chronic "carriers" to renew infection.

The Body's Defensive Agencies.—Another angle to the eradication of malaria rests, as previously indicated, in the cure of the "carriers" or in getting rid of the reservoirs of infection. We are convinced that the cure of many infections, including malaria, rests, in its final analysis, in the natural defences of the body; and that so-called specific drugs serve only to assist these defences to throw off disease. It has always been considered that quinine was directly destructive to the malaria parasites, until European investigators cultured blood, richly infected with malaria parasites, in solutions of quinine (1 to 2,500 and 1 to 5,000) and subsequently infected susceptible individuals with it.

This would indicate that the favorable results brought about by its administration in malaria are not effected by its action alone on the parasites, but by that plus something in the living organism. What the character of this "something" is, whether cellular or humoral, or both, we do not know.

Nutrition and Environment.—As these defensive agencies are functions of cells or fluids of the body, their efficiency must be directly reflected by the individual's state of nutrition. We have known for years that morbid conditions are greatly influenced by nutrition and environment, and we take advantage of these factors in the treatment of many diseases.

The cure of chronic malaria, then,—like the cure of other diseases—not only depends on the administration of so-called specific drugs, but it also becomes an economic problem. Unless a suitable and adequate food supply is provided, cures are difficult to obtain, and it is therefore a matter of great importance in any malaria-infected community to make food available and to see that it is adequate in quantity and quality.

Pink Tonic Tablet: Follow-up Treatment.—Because of the prevailing anaemia among the laborers, the pink tonic tablet (referred to above) was devised; and in all chronic cases, as well as in those convalescing from an acute attack, we endeavor to give these tablets, as a follow-up treatment because of their anti-malarial, tonic and haematogenic effects, over a period of 2 or more weeks.

At present, repeated thick-film blood surveys are made in the camps, and all those individuals with positive bloods are treated. We realize that a survey made on any one day in an infected malaria community probably does not reveal more than 50% of those actually infected, and therefore probably does not reflect the true incidence of the disease.

RESULTS OF THE PROGRAM

The program outlined above may be considered ideal, but it necessitates time and education to make it effective. The units which are immediately in charge of labor, and upon which we must rely for cooperation, are numerous and must

be enlisted and educated in the necessary details to carry out the entire program. All this can not be done hurriedly. The personnel must be made to realize that the efficiency of labor units depends largely on their physical and mental well-being.

Although the program in question has not by any means functioned with the maximum degree of efficiency which might be desired, we are able to report progress in the campaign, as judged from the following standpoints:

- (1) The number of malaria cases requiring hospitalization
- (2) The disease incidence as determined by repeated and extensive surveys by the thick-film method of blood examinations
- (3) The increase of the efficiency of labor under conditions where approximate estimates can be made

Average Number of Employees in 1925 . . . 46,258	Average Number of Employees
Average Number of Employees in 1926 . . . 42,181	
Average Number of Employees in 1927 . . . 42,851	
Average Number of Employees in 1928 . . . 43,630	

Hospital Malaria Cases Employees in 1925 . . . 11,036	Total Hospital Admissions of Employees Suffering from Malaria (Primary Diagnoses.)
Hospital Malaria Cases Employees in 1926 . 9,063	
Hospital Malaria Cases Employees in 1927 6,289	
Hospital Malaria Cases Employees in 1928 4,352	

Rate per Thousand per Annum in 1925 . . . 239	Hospital Admissions for Malaria Rate per 1,000 Employees per Annum
Rate per Thousand per Annum in 1926 . . . 215	
Rate per Thousand per Annum in 1927 . 147	
Rate per Thousand per Annum in 1928 . 100	

GRAPH 1

As to the first factor, the above Graph 1, and Table I, (based on reliable data) show the number of employees hospitalized for malaria as a primary diagnosis during the years 1925 to 1928, inclusive, in 8 Divisions.

In order to clarify the data in Table I, it should be stated that:

In the Colombia Division local conditions developed during the last few weeks of 1928 which prevented sanitary work and dispensary treatments, thereby materially affecting the data submitted.

In the Costa Rica Division, although some sanitary work was undertaken in 1926 and 1927, the control program was not completely organized until July, 1928. Since then, the results of the control measures have been very gratifying.

In the Guatemala Division the program was in full operation during the year 1928. In this Division the rainfall is heavy, and the mosquito-breeding areas are numerous and difficult or impossible to control.

In the Panama Division during 1928 no attention was paid to sanitation, and malarial-control rested solely on curative measures. The results show that sanitary procedure should not be neglected.

TABLE I

	Aver. No. of Employees				No. of Hospital Cases (Employees)				Rate per Thousand			
	1925	1926	1927	1928	1925	1926	1927	1928	1925	1926	1927	1928
Colombia	8,869	7,438	8,277	8,125	853	511	435	520	96.18	68.69	52.56	64.00
Costa Rica	6,944	6,540	6,434	6,386	1,089	1,699	1,429	942	156.83	259.75	222.10	147.51
Guatemala	5,371	4,957	4,531	4,729	1,746	1,492	946	638	325.08	300.99	208.78	134.91
Panama	3,313	3,092	2,803	2,690	763	510	310	323	230.30	164.94	110.60	120.07
Tela Railroad Co.	5,287	4,368	4,911	5,764	967	692	980	653	182.90	158.42	199.55	113.31
Truxillo Railroad Co.	4,543	4,693	4,905	4,800	1,179	922	899	778	259.46	196.46	183.28	162.05
Banes	5,596	4,997	4,788	5,263	2,904	2,296	628	282	518.94	459.48	131.16	53.58
Preston	6,335	6,096	6,202	5,811	1,535	941	662	216	242.27	154.51	100.29	37.17
Total	46,258	42,181	42,851	43,568	11,036	9,063	6,289	4,352	238.57	214.86	146.76	99.89

In the Tela Division a great deal of sanitary work was carried on, as well as curative measures; and the results in comparison with those of the previous years were gratifying.

In the Truxillo Railroad Company Division in 1928 both sanitary and curative measures in the field were neglected to some extent, and in addition there was a considerable importation of new labor from infected districts.

In the Banes and Preston Divisions in Cuba, the malaria-control program has been in effect for over two years, and the results are striking.

Graph No. 2 shows the number of employees hospitalized in 1928, as compared with the average number hospitalized annually during the 5-year period extending from 1924 to 1928, inclusive.

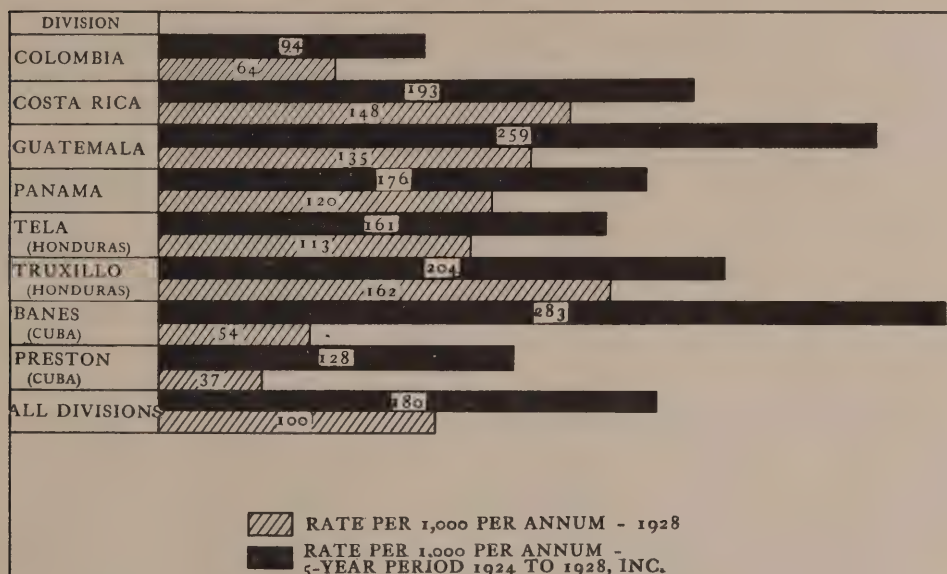
It may be argued that we are merely carrying our treatment to the camps and homes instead of conducting it in the hospitals. In answer to this, we submit data on the percentage incidence of infection by thick-film surveys over the period, 1926-1928. (See Table II, p. 103.)

Finally, in regard to one of the sugar plantations we have data on the efficiency

HOSPITAL ADMISSIONS FOR MALARIA

RATE PER 1000 EMPLOYEES PER ANNUM

(BASED ON PRIMARY DIAGNOSIS)



GRAPH 2

TABLE II*

	1928	1927	1926
Tela	18.6	24.3	23.9
Truxillo	35.0	33.5	21.0
Chiriqui****	35.6	26.7	****
Costa Rica	19.0	34.9	29.5
Colombia	15.2	21.3	21.0
Guatemala	27.6	***	40.1
Panama	22.9	21.9	27.1
Preston	***	24.2	34.8**
Banes	***	24.3	35.9

of labor units, as determined by the amount of cane cut per day, per unit, over the period—1924 to 1928, inclusive. These data are given below:

Year	Tons Cut per Day per Man
1924	.961
1925	.980
1926	.936
1927	1.233
1928	1.393

* The above surveys were all done by Dr. H. C. Clark. In 1928, as stated in his report, (p. 71 of this Annual Report) they were restricted to the most highly infected districts; or to groups of people who generally carry the highest incidence of infection—such as women and children, and men sick in the camps.

** Early in May, 1926, Dr. Clark made a survey of several districts in this Division, and found that 55.9% of the persons examined harbored malaria parasites.

*** He was unable to survey the Guatemala Division in 1927 or the Cuban Divisions in 1928.

**** Chiriqui is a new division recently opened up, and there were no active operations there in 1926.

A few extracts from a letter written by the Superintendent of Agriculture of one of the Divisions will serve to illustrate the present general attitude of men in charge of laborers towards the anti-malaria campaign.

There is no doubt in our opinion that the progress made through improved camp sanitation and the anti-malarial campaign of 1928 not only results in the better health and contentment of labor, but also in a considerable saving in money for railroad passes to the Hospital, as well as in a decrease in hospital charges for the care of men from our Department.

The Medical Superintendent's personal contact with all of our administration has done much to make the campaign a success. His letters to the Overseers, with copies to the Superintendents, Manager, and Superintendent of Agriculture, telling the results of blood tests, or of neglect in quinine administration or laxness in supervision of camp sanitation, have insured that these matters receive immediate attention. We know that the Overseers and Time-keepers now realize the importance of this work, and more or less competition has developed between them as to who shall have the cleanest camps and the fewest sick laborers.

The most striking results have been obtained in the decrease of malaria on those farms which had the highest percentages in previous years. We refer particularly to Oneida, Chickasaw, Creek and Yuma and to New Land Farms. Not only have the cases decreased in number to approximately 50% under 1927, but the majority of them usually occur in laborers who have recently come from the Interior bringing the malaria infection with them.

A feature of camp treatment is that, whereas when the campaign commenced laborers would do almost anything to avoid taking the "pills," they now request them when feeling unwell, and are not satisfied until they are supplied.

Up to the present time, we have been unable to obtain complete cooperation toward the carrying out of the ideal program; but conditions are constantly improving, and enough data have been submitted to show that sanitation and the early treatment of acute malaria are of great value.

FURTHER NOTES ON PLASMOCHIN

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Results in Series Treated with Plasmochin and Quinine.—During the year 1928, all cases of malaria admitted to this Hospital were treated with quinine and plasmochin combined; 2 pills of plasmochin compound, and 10 grains of quinine in addition, were given twice daily, which corresponds to a daily dose of 4 cgs. of plasmochin and 1.8 gms. of quinine. Our object was to determine whether this comparatively small amount of plasmochin—insufficient to cause toxic symptoms—would exert a satisfactory influence on the gamete forms of E.A. malaria. It may be said here, in anticipation, that we do not consider plasmochin

chin a new clinical cure for malaria nor, from this standpoint, comparable to quinine. The importance of plasmochin lies almost exclusively in its effects on the sexual forms of the parasite. Its routine use should be considered for prophylactic rather than for curative purposes.

In all, 233 patients were treated, 212 of whom had E.A. malaria. The combined drugs were given for from 5 to 8 days, or until the blood report was negative. All patients were discharged as soon as they were in fairly good condition and able to work; and we were unable to obtain data on relapses or the reappearance of crescents in the peripheral blood.

Of 212 E.A. malaria cases, 61, or 28.8%, showed crescents during the periods the patients were under observation. Twenty-three developed crescents after treatment was started, although never in great numbers, and then they were present only for a few days. The average time from the beginning of plasmochin-quinine treatment to the disappearance of gametes, was 5.5 days; the longest time was 12 days. Seven patients showed crescents in abundance (5 and more to 1 field), but in no case did they persist longer than from 6 to 9 days. No patient was discharged before the blood report was negative.

Results in this series of cases confirm our conclusion reached in previous years, and published in Annual Reports of the United Fruit Company: namely, that plasmochin frees the peripheral blood from gametes much more rapidly than any other drug used for the treatment of malaria.

"Disappearing" of Crescents.—We intentionally speak of the "disappearing" of crescents from the blood, because the peculiar effect of plasmochin is still open to discussion, and there is little evidence to prove that the gametes are really "destroyed" or "devitalized." We could not convince ourselves that following the administration of plasmochin the parasites showed evidences of degeneration as described by some authors. Every one familiar with the thick-drop method knows that frequently in the thicker parts of the blood-layer the crescents appear only as lumps of pigment, with torn outlines and irregular shapes, and almost devoid of any sign of protoplasm or nucleus; whereas in the marginal parts of the drop they show up in perfect form.

Effect of Plasmochin on Blood Cells.—A laboratory observation may be mentioned here,—namely, that after several days of plasmochin treatment, especially in anaemic cases with many gamete forms, the thick drop shows a pronounced basophilia of erythrocytes, much more marked than is generally observed during the convalescence from malaria in cases treated with quinine only. We consider this basophilia as the expression of a stimulating effect produced by plasmochin upon the regeneration of blood cells.

Effect of Plasmochin on Crescents.—It is possible that plasmochin does not so much attack the crescents already formed as it prevents the formation of new ones. The development of gametes, which probably originate in the spleen and the bone marrow, goes on after the peripheral blood is free of ring forms. This accounts for the fact that some patients, clinically cured, carry crescents

for weeks and months,—it is certainly a more plausible explanation than to hypothecate an extremely long span of life for the gametes. In plasmochin we have a drug which, in toxic doses, affects the blood and haematopoietic system selectively (haemolysis, strong basophilia of erythrocytes, nucleated red cells, regenerative leukocytosis). We are therefore inclined to believe that the action of plasmochin on crescents is not direct, in the strict sense of chemotherapy, but indirect, creating unfavorable conditions for the development of gametes in the bone marrow or the spleen. This we offer as an explanation why, after the beginning of treatment, the crescents still persist for from 5 to 7 days, or longer, until the stimulus on the haematopoietic system is strong enough to prevent a new crop of gamete forms. In other words, those already formed live their normal span of life, but are not followed by younger generations.

CONCLUDING OBSERVATIONS

In our 233 cases we saw no untoward effects from plasmochin in the nature of gastrointestinal disturbances, cyanosis, haemolysis, or damage to the leukopoietic system; although it must be admitted that the series is comparatively small, and that unexpectedly a single susceptible patient may be encountered who will develop toxic symptoms even after the administration of only 4 cgs. daily, as we previously observed and reported in 1927 in the Annual Medical Report (page 62). However, the danger does not seem greater than with regular quinine treatment, which may cause grave symptoms in persons with a special idiosyncrasy to that drug.

We had the opportunity of observing a striking case of quinine idiosyncrasy in which plasmochin was tolerated well. When quinine-plasmochin treatment was begun this patient developed nausea, vomiting, petechial skin haemorrhages, and bleeding from mouth, nose and urinary tract. It was of interest to determine which of the drugs was responsible for the incident. Both were discontinued; and when the patient was again in fairly good condition, a 10-grain dose of quinine was given by mouth. An hour later a violent reaction ensued with chill, fever of 103°F. and gastric distress. The blood showed a leukopenia of 2500 and a complete absence of granulocytes, but numerous normoblasts. The experiment was repeated later with 5 grains of quinine, and with nearly the same results. Later on, 4 cgs. of pure plasmochin were given and continued for 7 days without producing any untoward effect. This case proved to us that quinine and plasmochin idiosyncrasies have nothing in common, and that one drug may be given with safety when the other is not tolerated.

Our experience with dispensary distribution of plasmochin was not extensive enough to warrant conclusions regarding its value and the safety of this method. The Hospital records, however, seem to prove that 4 cgs. of plasmochin daily, in addition to quinine, are a safe and effective dosage which can be recommended for routine malaria treatment.

INCIDENCE OF MALARIA IN DEEP TISSUES

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SUMMARY OF CONDITIONS FOUND

From August to December, 1928, the deep tissues of 36 cases were examined for evidence of malaria infection. Of these, 17 were autopsies and 19 were obstetrical cases; 14 of the patients were males, and 22 were females; 2 of the 36 cases were less than 12 years of age, and 8 were over 50 years.

Of the 36 cases, 16 showed in one or more of their deep tissues positive evidence of malaria infection: either parasites, or phagocytic pigment in clumps. The positive cases occurred in 12 West-Indian negroes and 4 colored Latin-Americans. The total number examined included 25 West-Indian negroes, 10 colored Latin-Americans, and 1 white North American. Crushed pieces of tissues from gray matter of the brain (basal ganglia or cortex) were mounted and stained for malaria parasites after the manner of a thin-film of blood; whereas crushed material from rib-bone marrow, spleen or placenta, and also blood specimens from the umbilical cord of the newly born, were mounted and stained by Giemsa after the manner of a thick-film of blood.

Among the 36 cases, malaria appeared twice as a primary diagnosis, and twice as a secondary diagnosis. In the other 32 cases the peripheral blood had been examined several times for malaria and found negative.

In 14 of the 36 cases there was a distinct history of malaria infection during the past 4 years (treatment in the Hospital or the out-patient clinic).

Within the last 4 years, *4 of the 16 positive* cases had been under treatment for malaria.

Among the 16 positive cases, the parasites in 12 were found at post-mortem examinations, of which, altogether, 17 were performed; and 4 placentas (out of a total of 19 deliveries) proved positive.

These 2 groups may be separately considered:

I. AUTOPSIES

Among the 12 post-mortem examinations in which positive evidence of malaria infection was found, 4 were diagnosed as malaria (E.A.) on positive blood-findings prior to their death. Two of the 12 post-mortem cases died from cerebral

malaria and the diagnosis was confirmed by autopsy. In the other 10 cases the causes of death were:

Cause of Death		Number of Cases
Blackwater fever . . . (2nd diagnosis E.A. malaria)		1
Appendicitis (2nd diagnosis E.A. malaria)		1
Strangulated hernia		1
Tertiary syphilis		2
Extensive burn of the 3rd degree		1
Bronchopneumonia		1
Chronic parenchymatous nephritis		1
Multiple abscesses of the lungs		1
Pernicious anaemia		1
		10
Parasites found in the brain in		8 cases
Parasites or pigment found in the spleen in		9 cases
“ “ “ “ “ “ bone marrow in		7 cases
All 3 organs were found to be simultaneously infected in		4 cases
2 “ “ “ “ “ “ “ “		4 cases
Brain and bone marrow in		0 case
Spleen and brain in		2 cases
Spleen and bone marrow in		2 cases

Only single-organ infection was found in 4 cases, as follows: Brain alone was found infected in 2 cases (1 a 3-year-old child who died from cerebral malaria, the other a 70-year-old woman who died from tertiary syphilis); the bone marrow alone was found infected in 1 case; the spleen alone was found infected in 1 case.

Assuming 5 ounces to be the normal weight of the spleen of an adult, the spleen was found heavier than normal in 9 cases of which 6 were infected, and was found normal or less than normal weight in 8 cases of which 6 were infected.

Of the 9 cases in which the spleen was found *heavier* than normal the organ itself was found infected in 5 cases.

Of the 8 cases in which the spleen was normal in weight or less, the organ itself was found infected in 4 cases.

II. OBSTETRICAL CASES

Among the 19 cases of delivery in which an examination of smears from the placenta and the umbilical cord was made, there were 4 cases in which the mother had a palpable spleen, and in 1 case the patient was being treated for aestivo-autumnal malaria fever. In 4 cases the placenta showed malaria parasites or pigment, but in only 1 of these cases was the spleen palpable. All 4 positive placenta cases delivered full-term children.

Case 1 gave a history of a malaria infection, 8 months previously. The spleen at delivery was not palpable.

Case 2 had suffered 2 years before, from tertian malaria. The smears from her placenta showed numerous small ring-form parasites. The spleen was not palpable.

Case 3, whose placental smear showed clumped pigment and some ring forms of pigmented parasites, had the following history: In 1926 she suffered from tertian malaria; in February, 1927, and March, 1928, blood examinations for malaria were negative. She was diagnosed in February, 1927, and July, 1928 (3 months before she was delivered), as "clinical malaria." Spleen then and at delivery was not palpable.

Case 4, when admitted for delivery, showed E.A. rings in the peripheral blood; the spleen was palpable. In the placental smear, pigment, in clumps, was found.

In no instance were malaria parasites found in the blood taken from the cord of the new born.

CONCLUDING REMARKS

The types of parasites found in the autopsy and delivery cases were ring forms, some of them showing pigment. In no case were crescents positively demonstrated.

Though no conclusions should be drawn from this rather small number of observations, we believe that they throw a certain light upon the ratio (4:16, or 25%) between clinically proved malaria and its incidence in deep tissues.

PERNICIOUS MALARIA—WITH CASE REPORTS

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PRELIMINARY CONSIDERATIONS

Early Diagnosis Important.—The physician engaged in the practice of tropical medicine has frequently to deal with so-called pernicious forms of malarial fevers.

The early diagnosis of a malarial infection with predominating nervous symptoms or marked by a comatose condition, is of paramount importance. Quite frequently the medical man is summoned to attend a case that clinically resembles cerebrospinal meningitis or an afebrile comatose condition, suggesting diabetic coma or hemiplegia. The history of the average case is of little value, and it is only the microscopical blood-examination that makes possible a rapid differential diagnosis. According to Craig, the term "pernicious" as used in the nomenclature of malaria indicates infections in which some one symptom or

group of symptoms predominates so as to color the clinical picture, and threatens the life of the patient. The aestivo-autumnal parasite is usually the one responsible; but it is important to keep in mind that the same species of plasmodium which causes the mildest infections is also capable of causing rapidly fatal results.

In the temperate zone, the malignant forms of malaria are rare and occur only in the summer and autumn months, while in Central America the cases occur continuously throughout the year; and more patients, as a rule, come from the outlying districts where new farms are being developed, especially during the period of the felling of trees and making of drains. In frontier work of this character one can readily notice an ascending curve in the number of malignant cases of malarial infections.

Contributing Factors in Pernicious Malaria.—A glance at the Limon Hospital records between 1923 and 1927 shows that 7,963 cases of microscopically positive malaria were seen, and of these 5.17% were of a malignant or pernicious type and caused the death of 116 patients. The reasons why malaria at times becomes pernicious are not as yet well understood. Susceptibility of the patient, preexisting diseases of the viscera, exposure for long periods to the tropical sun, unbalanced diet deficient in green vegetables, the number of plasmodia present, etc., are all important factors in the development of the pernicious type. I have observed also that individuals suffering from diseased tonsils are prone to develop severe symptoms if they ever contract malaria. Pernicious symptoms are seldom found in individuals of the negro race. The European, the North American, and particularly our native Latin laborers are susceptible to the infection. The Chinese have a peculiar tendency to develop haemoglobinuric fever, and children are more prone to convulsions.

Number of Parasites and Severity of Attack.—Golgi's law, that the severity of the attack is determined by the number of parasites has been generally accepted; and cases with a large number of parasites in the peripheral circulation usually develop the comatose type of malaria. It is not possible always to attribute the perniciousness to the number of parasites. There are many serious attacks of comatose, delirious or tetanic forms of malaria in individuals in whom, from the beginning to the end of the attack, parasites are scarce, at least in the peripheral blood. We have had this experience with several patients who were suffering from cerebral types. I remember the case of a colleague—a member of our staff—who contracted aestivo-autumnal infection and who, 2 months after the first attack, had an acute paroxysm and was delirious for several hours. The ordinary blood-film examination for malaria was negative, but when we centrifuged 10 cc. of his blood, according to Bass and Johns' method, and stained several slides made from the sediment, after a tedious search we were able to discover only 1 parasite. The patient recovered from his delirium a few hours after the administration of an intravenous injection of quinine.

Advantages of Bass and Johns' Method.—It is in cases of delirious or convulsive

forms of malaria that I have experienced greatest difficulty in finding parasites in the peripheral circulation. For this reason I wish to call attention to the advantage of Bass and Johns' method, in preference to the ordinary thick-film procedure. The former takes advantage of the fact that parasitized red cells are lighter than the others and rise to the top of the sediment when the blood is centrifugalized at high speed. The authors of the method claim that 90% of the parasites in 10 cc. of blood can be collected upon the slide, and that the best results are obtained with aestivo-autumnal crescents and adult tertian and quartan parasites. A decided advantage over other methods is the fact that parasites and all blood cells are perfectly preserved and that they stain exactly as they do in ordinary smears.

Parasite Localization in Body Organs.—The localization of the parasites in different organs of the body is believed to be the cause of pernicious symptoms, particularly those of the cerebral type. It is claimed that the symptomatology is due to the blocking of the cerebral capillaries by parasites in infected erythrocytes. Dr. William M. James, of Panama, who has had considerable experience in the post-mortem examination of fatal malarial cases, does not think that the symptomatology of these types of malaria—particularly coma or delirium—is due to this blocking or circulatory phenomenon, but believes that what really occurs is a congestion of the brain with oedema of the endothelium of the capillaries as the result of a toxin. The localization of these toxins in malaria has been clinically demonstrated.

CLASSIFICATION OF PERNICIOUS FEVERS

Based on the most prominent symptoms present, the following types can be recognized: comatose, delirious, tetanic, clamtic, haemorrhagic, choleric, hemiplegic, dysenteric, pneumonic and typhoidal. In this article I am dealing only with the comatose and delirious forms, with which I have had more experience. The algid and dysenteric forms, I understand, are very common on the Pacific coast of this country. Occasionally we see cases of the pneumonic type here in Port Limon.

COMATOSE MALARIA

This is the most common form of pernicious malarial fever encountered in this Division. The coma develops either suddenly or gradually during a paroxysm of fever. Fortunately the sudden development is rare, but when it does occur it is invariably fatal. When attacked by this form the patient has generally suffered from repeated attacks of malaria and, while still feeling ill, is suddenly stricken with profound coma. The face is suffused; pupils are contracted; pulse is at first full and bounding, later soft, rapid and thready; the respirations are hurried and sometimes stertorous; and the temperature runs between 101°F. and 103°F.

Death generally occurs within 3 days. The following cases will illustrate the characteristics of pernicious malaria; Case 1 typifies the grave comatose type.

CASE REPORTS

Case 1.—S. G., Costa Rican, aged 57 years, brother of a doctor, contracted malaria on one of the farms. He took a few doses of quinine and for a while thought that the attack was all over. A few weeks subsequently he had another paroxysm, treated himself in the same manner as previously and recovered, apparently. One day, however, he did not feel well, had a little fever and passed into a state of coma. The same day, he was brought to the Hospital. On admission the patient was in profound coma, incontinent, and had a rectal temperature of 102°F. The skin and conjunctivae were of light lemon hue; pulse was 102, soft and irregular; breathing stertorous; liver and spleen were slightly palpable; eyes showed pin point pupils; and there was absence of patellar reflexes. A catheterized specimen of urine contained only traces of albumin. The microscopical examination of the blood revealed a massive infection with the aestivo-autumnal parasites, scarcely an erythrocyte being free from them. The patient died 27 hours after admission.

The most common form of comatose malaria is that which develops gradually during an attack of fever. The patient is restless and mentally depressed, later passing into a state of somnolence, which deepens into stupor and finally into coma. This type, if early recognized and promptly treated, invariably recovers.

Case 2.—P. D., laborer, native, well-nourished male, of good physique, aged 30, was admitted to the Hospital August 27, 1926. He gave a history of attacks of intermittent fever, chills and headache. He stated that he had been taking at intervals quinine 10 grains 3 times a day. The skin was dry and slightly icteric; lungs and heart were normal; spleen was enlarged, and tender on palpation; temperature 101°F. The laboratory reported a great number of aestivo-autumnal parasites in the blood. Haemoglobin was 45%, and there were traces of albumin in the urine.

Quinine was given by mouth, but the temperature remained high until the 3rd day, when, following a chill, it rose to 105°F. For a while the patient was nervous and excited, calming down later, however, and going to sleep. He became comatose during the night—the temperature falling to 104°F. He was treated with quinine intravenously, and gradually recovered consciousness 16 hours later.

Forms of malaria marked by delirium and convulsions are common in this country and the symptoms usually increase as the temperature rises. The patients appear very much excited; the eyes are injected; there is hyperaesthesia and also exaggeration of all reflexes. The temperature usually ranges between 103°F. and 105°F., and the pulse is full and strong. The patient laughs or cries and has delusions, and there are occasional convulsions and grinding of the teeth. Contrary to what occurs in comatose cases, the parasites are very scarce in the peripheral circulation; and not uncommonly prolonged search of several slides is necessary before a parasite can be found.

Case 3.—C. R., a robust white female, aged 30 years, weighing about 195 lb. On November 12, 1925, her husband called me to see her. She complained

of severe sore throat, chills and aching limbs. Her face was very congested; and the temperature was 103°F. She had acute follicular tonsillitis. The blood examination for malaria was negative.

The classical treatment for acute tonsillitis, including quinine, was given. I did not see the patient again until the morning of the 5th day, when I was urgently called and found her having strong tetanic convulsions, with face suffused and eyes injected. Her temperature was 105°F. Spleen and liver were not palpable. She was brought to the Hospital, a blood examination by Bass and Johns' method was made, and 3 aestivo-autumnal parasites were found. An intravenous injection of quinine was given immediately. The convulsions ceased 2 hours afterward. The injection of quinine was repeated that evening, and next morning the temperature was normal. The patient made a good recovery.

Case 4.—J. G., native, laborer, aged 26 years, was admitted to the Hospital September 15, 1927, with a temperature of 105°F. He was very much excited, with face twitching and lips trembling, and was talking and crying. He remained quiet for short periods, but again became delirious and excited, left his bed, and tried to jump through the window. It was necessary to restrain him. During the night he appeared fairly calm, but was restless and unable to sleep.

September 17th.—The temperature had dropped to almost normal, after a copious perspiration. His mind was clear and, realizing his behavior on the previous day, he expressed a feeling of remorse.

September 18th.—The temperature rose again to 103°F.; he again became excited, and had fitful sleep disturbed by nightmares.

September 19th.—Temperature normal; patient very much depressed and despondent. The following morning he was mentally normal. His recovery was prompt and he left the Hospital a few days afterward.

In this case repeated blood smears were examined after each rise of temperature, with negative results; but on examination of the patient's blood by Bass and Johns' method a mixed infection of tertian and aestivo-autumnal malaria was discovered.

TREATMENT

The treatment refers only to the acute attack of coma, delirium or convulsions, for when these symptoms have subsided the regular routine treatment of quinine and plasmochin by mouth is started.

In treating these cases of pernicious malaria we depend solely on quinine; but in order that the best and speediest effects of the drug may be secured, it must be given intravenously. We use a solution containing 1 gram of quinine dihydrochloride in 10 cc. of normal salt solution. The injection must be given slowly—3 minutes to inject 10 cc. It is advisable to use a 20 cc. syringe; and to slowly draw some blood and allow it to mix with the solution before injecting. It is also advisable to inject 1/30 grain of strychnine 10 to 15 minutes prior to the administration of the quinine injection, in order to prevent the possibility of the quinine exerting a depressing effect on the heart. Two daily intravenous injections of 1 gram of dihydrochloride of quinine, diluted with 10 cc. of normal saline, for 2 or 3 days is the average quantity we have found sufficient to over-

come the acute stage of coma, delirium or convulsions. Then routine malaria treatment can be established. The use of hot or cold packs, constant application of ice caps to the head, and stimulation and elimination are also important features of the treatment.

ADRENALIN IN MALARIA

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SPECIAL PRELIMINARY REMARKS

I know of no literature regarding the use of adrenalin in the treatment of pernicious malaria; but I have noted the beneficial clinical results obtained by Dr. N. P. Macphail, who has used it rather extensively in cases of persistent nausea and vomiting incident to severe malaria infection.

In pernicious attacks, whether of the cerebral, algid, or paratyphoid types, when there was sluggish reactions from the use of quinine, intramuscularly or orally, if the drug was supplemented with subcutaneous injections of adrenalin chloride in doses of from 8 to 15 minims, there frequently occurred an acute exacerbation of the symptoms; and, though parasites could not be previously found in the peripheral blood, they appeared subsequently in comparatively large numbers. The sequence of events, in the clinical improvement and prompt recovery of the patient, was most gratifying.

Apparently the adrenalin injection caused a vaso-constriction of blood vessels, including those of the spleen and other haemotopoietic organs, and forced the parasites into the active circulation, thereby relieving preexisting stasis or loss of vascular tone. Keeping in mind these observations, I began to use the adrenalin injections in all cases of pernicious malaria, irrespective of the type or character of the clinical symptoms. I am presenting in this paper a few case reports that will illustrate the prompt results obtained.

COMMENTS ON THE CASES THAT FOLLOW

It may seem curious to the reader to note that, in about one-half the cases reported, parasites were not found in the peripheral blood. This can be accounted for as follows:

The cases in this Division come from the camps which are inspected daily, and all those suffering from fever are promptly given quinine in large dosage before they are sent to the Hospital for treatment. It is well known to all malariologists, accustomed to deal with E. A. malaria, that when the parasites

are about 18 hours old, they are caught in the deep viscera, and although the peripheral blood may have contained enormous numbers of parasites when the blood was first examined, a smear taken a couple of hours later may fail to reveal parasites, or only comparatively few may be found.

In this series of cases, unfortunately, only one thick-film blood examination was made. From the clinical standpoint, however, unquestionably the cases reported were pernicious forms of malaria.

CASE REPORTS

Case 1.

History.—E. U., native, female, aged 18 years, was admitted to the Hospital on May 1, 1928. She had been complaining of severe headache when one day on returning from school, she suddenly became delirious, in which condition she entered the Hospital. The temperature on admission was 102° , pulse 120, respirations were 24, and she had incontinence of urine. Her blood was positive for E. A. malaria.

Treatment.—For 3 days the patient was given quinine intramuscularly, 15 grains every 6 hours, supplemented with bromides, without obtaining relief. On the morning of the 4th day 15 grains of quinine were administered intramuscularly 20 minutes subsequent to an injection of 6 minims of adrenalin chloride solution, and both injections were repeated at noon. Spinal puncture was then performed, and 20 cc. of spinal fluid were removed. This fluid was colored, which suggested that there had been some haemorrhage into the spinal canal. Next day the patient was much improved, mentally, but the quinine and adrenalin hypodermics were repeated in the morning and at noon, and also on the following day. On the 7th day after admission the temperature and pulse were normal, the adrenalin and quinine hypodermics were discontinued, and, from that time on, 10 grains of quinine were administered orally 3 times daily. The patient was discharged in good condition on May 15th.

Case 2.

History.—M. N. L., native, male, aged 13 years, was admitted to the Hospital on May 19, 1928. He was unconscious and no personal history was obtainable. The temperature was 104° , pulse 144, and respirations were 40. He repeatedly vomited, and was delirious. The eyes showed nystagmus; blood was positive for E. A. malaria parasites, and urine showed traces of albumin.

Treatment.—The patient was given 10 grains of quinine intramuscularly, repeated every 6 hours, along with a digitalin (1/100) hypodermic injection. Hot-water bags, blankets, and ice cap to the head were applied. The next day the patient was still unconscious and the temperature was $103\frac{1}{4}^{\circ}$, pulse 144. Adrenalin solution 5 minims subcutaneously and 10 grains of quinine intramuscularly were administered morning and night. Spinal puncture was made, and 15 cc. of clear transparent spinal fluid were withdrawn under normal

pressure; but after 15 cc. had been removed, blood appeared in the fluid, which demonstrated the acute congestion of the cerebral blood vessels. After the administration of adrenalin and quinine hypodermically, the temperature and pulse became normal, with complete relief of symptoms. The patient was discharged on May 31st in good condition.

Case 3.

History.—F. H., native, male, aged 30 years, was admitted to the Hospital on April 13, 1927, unconscious, and no history was obtained. The temperature was 102°, pulse 92, and respirations were 20. He was delirious; and had nystagmus and a positive Kernig. The one examination of the blood was negative for malaria parasites.

Treatment.—The patient was given 22½ grains of quinine intramuscularly twice daily, and no relief of the symptoms was observed. On the 2nd day 7 minims of adrenalin hypodermically, followed by 15 grains of quinine intramuscularly, were given morning and noon, after which the patient regained consciousness and the temperature and pulse became normal. He was discharged on April 20th, in good condition.

Case 4.

History.—S. R., native, male, aged 12 years, was admitted to the Hospital on May 23, 1927, in a delirious condition and the history was not obtainable. The temperature was 99°, pulse 120, and the blood was negative for malaria parasites. The skin was pale; nystagmus was present; abdomen distended; spleen enlarged; and the Kernig positive.

Treatment.—The patient was given 5 minims of adrenalin subcutaneously and 7½ grains of quinine intramuscularly twice daily for the 1st and 2nd days, with excellent results. On the 3rd day, quinine was administered orally. He was discharged on May 1st, in good condition.

Case 5.

History.—M. R. B., male, Portuguese, aged 33 years, was admitted to the Hospital on July 22, 1928. The patient had had fever and chills daily for 8 days, accompanied by headache and anorexia. The tongue was coated, and the liver and spleen were tender on pressure. The blood was negative for malaria parasites. The patient had been taking quinine combined with plasmochin routinely for 6 full days, and was running a daily temperature of from 101° to 102°.

Treatment.—Fifteen grains of quinine intramuscularly had been administered twice daily for 2 days without any results, until 8 minims of adrenalin subcutaneously and 15 grains of quinine intramuscularly were given. The patient had a chill and the temperature went up to 104°, pulse 112. One hour afterward the temperature and pulse were normal, and complete relief of symp-

toms was noted. The patient was discharged on August 3rd, in good condition.

Case 6.

History.—F. C., native, male, aged 26 years, was admitted to the Hospital on May 20, 1927. He had had fever and chills daily; also anorexia and nausea for 6 days. His nutrition was poor; skin pale; tongue coated; liver tender at gall bladder region, and spleen enlarged and tender. The blood was negative for malaria.

Treatment.—He was given 15 grains of quinine intramuscularly twice daily without any relief. Subsequently 8 minims of adrenalin subcutaneously followed by 15 grains of quinine intramuscularly were given twice daily for 2 days, relieving all symptoms. The patient was discharged on May 30th, in good condition.

Case 7.

History.—G. T., native, male, aged 25 years, was admitted to the Hospital on February 26, 1928. He had had fever and chills daily; also headache and nausea, for 4 days. The skin was pale and jaundiced; tongue coated; sclera, jaundiced; hepatic and splenic regions were tender on pressure; spleen was enlarged; temperature 103°, and pulse 120. Blood was negative for malaria parasites. Upon examination on the day following admission his blood revealed E. A. malaria parasites. The patient had been under quinine treatment for 2 days without any relief of symptoms, and the temperature was still high.

Treatment.—Eight minims of adrenalin hypodermically and 15 grains of quinine intramuscularly were administered, and all the symptoms were relieved. The patient was discharged in good condition after 6 days of treatment.

Case 8.

History.—J. C., male, native, aged 17 years, was admitted to the Hospital on May 23, 1928, in an unconscious condition. Skin hot and moist; heart and lungs normal; spleen palpable and tender; patient was asthenic, vomiting and delirious. The temperature was 103°, pulse 140, blood positive for E. A. malaria parasites, about 50 per field (thick film).

Treatment.—Fifteen grains of quinine intramuscularly preceded by 10 minims of adrenalin subcutaneously, relieved all the symptoms on the second day, and the temperature was normal. This treatment was followed by administration of quinine and plasmochin tablets by mouth. The patient was discharged, after 8 days of treatment, in good condition.

CONCLUSIONS

The case reports given above are representative of a large number of cases which have been treated in the same manner during the past two years. I believe that the use of adrenalin in conjunction with quinine, in the treatment of serious cases of malaria, deserves further study.

OBSERVATIONS IN INDUCED MALARIA

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United Fruit Company Hospital

Almirante, Panama

Serological examinations of the spinal fluid in a series of cases revealed that syphilis of the central nervous system is of more frequent occurrence among the negro labor class of this Division than is usually expected in people of that race; as 7 (35%) out of 20 cases gave positive results (M. T. R.). We treated some of these, and also a few neurological cases, by inoculating them with malaria. The observations regarding the course of the malaria infections, which were made in this therapeutical series, are herewith submitted.

Six patients were inoculated. They were male West-Indian negroes, all of whom had passed the 3rd decade and had been employed as farm workers in this Division for from 6 to 20 years. They were in a rather good general condition and in a fair state of nutrition.

The following method was used: They were given intravenous injections of from 5 to 8 cc. of venous blood which had been taken from a patient suffering from an acute attack of aestivo-autumnal malaria (only ring forms in the blood). Several experiments with intramuscular injections of smaller doses of blood infected with benign forms of malaria were abandoned, as the results were unsatisfactory. Before the inoculation was performed, the blood cells of the donor were typed with those of the recipient, and use was made of the blood of only those malaria donors whose red cells were not agglutinated by the recipient's serum. (According to a recently expressed opinion, inoculation may fail to infect if the blood groups are incompatible, as the donor's erythrocytes containing the malaria parasites are injured or destroyed.) The results obtained with this method are given herewith, in detail:

CASE No. 1

S. L., negro, male, aged 50 years; and employed for 15 years as a laborer in this Division. For the past 4 years he had been confined to the Hospital.

Clinical Diagnosis: Multiple sclerosis.

First Inoculation: 6/18/28 3 cc. of blood from tertian-malaria case, injected intramuscularly. Result negative.

Second Inoculation: 7/14/28 5 cc. of blood from quartan-malaria case, injected intramuscularly. Result negative.

Third Inoculation: 9/11/28 5 cc. of blood from E. A. malaria case, injected intravenously. 9/28/28 E. A. rings appeared; 10/6/28 rings disappeared,

some crescents were found. 10/8/28 treatment started (0.045 gm. plasmochin and 1.56 gms. quinine sulphate daily). 10/13/28 crescents disappeared. From 10/16/28 to 10/20/28 no treatment. From 10/21/28 to 10/24/28 plasmochin and quinine treatment repeated.

Fourth Inoculation: 11/22/28 8 cc. of aestivo-autumnal-malaria blood from a heavily infected case, injected intravenously. Result negative (daily blood examinations until December 31, 1928).

Comments.—The patient showed no fever during the period of infection; he did not lose weight, nor did his haemoglobin fall.

CASE No. 2

J. G., negro, male, aged 60 years; employed for 20 years in this Division, and had been confined to the Hospital for 4 years. *Clinical Diagnosis:* Multiple sclerosis.

First Inoculation: 9/11/28 5 cc. of blood from E. A. malaria case, injected intravenously. 9/20/28 rings appeared. 9/27/28 rings disappeared; crescents appeared, and were found until 10/12/28. From 10/13/28 to 10/15/28, treatment with plasmochin and quinine sulphate (0.045 gm. and 1.375 gms. daily). From 10/16/28 to 10/20/28, no treatment. From 10/21/28 to 10/24/28, plasmochin and quinine treatment repeated.

Second Inoculation: 11/16/28 5 cc. of E. A. malaria blood, injected intravenously. In daily blood examinations until 12/7/28 no parasites were found.

Third Inoculation: 12/7/28 8 cc. of E. A. malaria blood, injected intravenously. The blood remained free from parasites for 3 weeks; then, 12/28/28, E. A. rings appeared. 1/4/29 treatment started, daily doses of plasmochin 0.04 gm. and quinine sulphate 1.50 gms. 1/7/29 rings disappeared. 1/14/29 treatment discontinued for 15 days, and then repeated for 10 more days.

Comments.—During both periods of infection, no feverish reaction was observed, and no loss of weight nor subjective complaints were noticed. The haemoglobin dropped from 75% to 70%.

CASE No. 3

H. B., negro, male, aged 66 years; employed for 14 years in this Division. *Clinical Diagnosis:* Cerebellar ataxia.

Inoculation: 9/11/28 5 cc. of aestivo-autumnal blood, injected intravenously. 9/22/28 first appearance of rings. 9/23/28 to 9/25/28 continuous fever of 102°F.; after that, temperature normal. Rings found in the blood until October 2nd, and disappeared definitely after 1 day of treatment, which consisted of plasmochin 0.045 gm. and quinine 1.56 gms. daily for 6 days.

Comments.—This patient was the most poorly nourished of our group. He reacted from the infection with subjective complaints—loss of appetite, headache, and a decrease of 2 lbs. in weight.

CASE No. 4

G. L., negro, male, aged 34 years; employed in this Division for 16 years.
Clinical Diagnosis: Cerebrospinal syphilis.

First Inoculation: 11/17/28 8 cc. of E. A. malaria blood, injected intravenously. Result negative.

Second Inoculation: 12/7/28 8 cc. of E. A. blood, injected intravenously. 12/11/28 E. A. rings appeared, and were present until 12/20/28 without treatment. From 12/21/28 until 12/27/28 treated with plasmochin 0.04 gm. and quinine 1.70 gms. daily. 12/25/28 rings disappeared definitely. From 1/1/29 to 1/7/29 the treatment was repeated.

Comments.—The temperature never exceeded 99°F. The patient complained of slight pains in the head and limbs, and loss of appetite. The weight, however, increased slightly during the period in question; and the haemoglobin remained the same.

CASE No. 5

A. R., negro, male, aged 42 years; employed for 6 years in this Division.
Clinical Diagnosis: Cerebrospinal syphilis.

Inoculation: 11/21/28 8 cc. of E. A. malaria blood, injected intravenously.

E. A. rings did not appear in the peripheral blood until 12/18/28. Treatment began on 12/27/28 with plasmochin 0.04 gm. and quinine 1.70 gms. daily. 12/30/28 rings disappeared. Treatment was continued for 6 days and repeated, after an interval of 5 days, for 6 more days.

Comments.—On the 23rd and 24th of December the patient had rises of fever to 104°F., but it dropped spontaneously before treatment with quinine was started. The patient felt rather ill, and there was a loss of 8 lbs. in weight.

CASE No. 6

D. B., aged 45 years; employed for 18 years in this Division. *Clinical Diagnosis.* Cerebrospinal syphilis.

First Inoculation: 11/16/28 5 cc. of E. A. malaria blood injected intravenously. Result negative.

Second Inoculation: 12/7/28 8 cc. of E. A. malaria blood, injected intravenously. 12/17/28 first appearance of rings. 12/26/28 treatment was started with plasmochin 0.04 gm. and quinine 1.70 gms. 12/28/28 blood became free of parasites. After 6 days of treatment, it was discontinued for 5 days, and then repeated for 6 more days.

Comments.—During the entire period of infection the patient was free of fever and there were no subjective complaints, although he lost 2 lbs. in weight.

SUMMARY

A group of 6 West-Indian male colored laborers were given therapeutic inoculations with malarial blood. All the men had been employed in this location for periods varying from 6 to 20 years. In 2 cases a malarial infection dur-

ing the last 4 years could be excluded with certainty, as the patients were hospitalized for disabling nervous conditions and had not been out of the Hospital during that 4-year period. Infection with malaria was effected successfully only by intravenous inoculation in all cases.

In 4 cases the malaria ran its course without fever. In 2 cases there was a febrile reaction lasting 2 and 3 days respectively. In each case the fever disappeared before the anti-malaria treatment was started. In 5 cases the parasites showed a tendency to decrease in number, or even to disappear spontaneously. In 2 instances gametes appeared in the blood. An attempt to reinfect these 2 patients within 4 weeks after a short treatment with quinine and plasmochin, was unsuccessful. One of them was reinfectd 3 weeks later; but only after a period of incubation of 3 weeks did the blood show parasites.

In spite of the precaution not to transfuse blood between patients with incompatible blood groups, the infections ran, in all 6 cases, a very mild course.

EDITOR'S NOTE

Some interesting conclusions may be drawn from the experiments described above. It is generally believed by clinicians working in tropical countries that negroes rarely suffer from neuron degenerations of the central nervous system resulting in paresis and locomotor ataxia. Whether or not this can be accounted for by their continual exposure to malaria infection, is questionable.

Inoculation of aestivo-autumnal blood for the treatment of paresis occurring in the white race has been abandoned because of the large number of resulting fatalities, and the benign forms are now routinely used.

The negro race has apparently developed a high tolerance to malarial infection, as fully demonstrated by the large quantities of highly infected blood given intravenously with little or no reaction.

It is probable that the negro race has been exposed to malarial infections for exceedingly long periods, and in consequence has developed a high degree of tolerance to the disease which the white race does not possess.

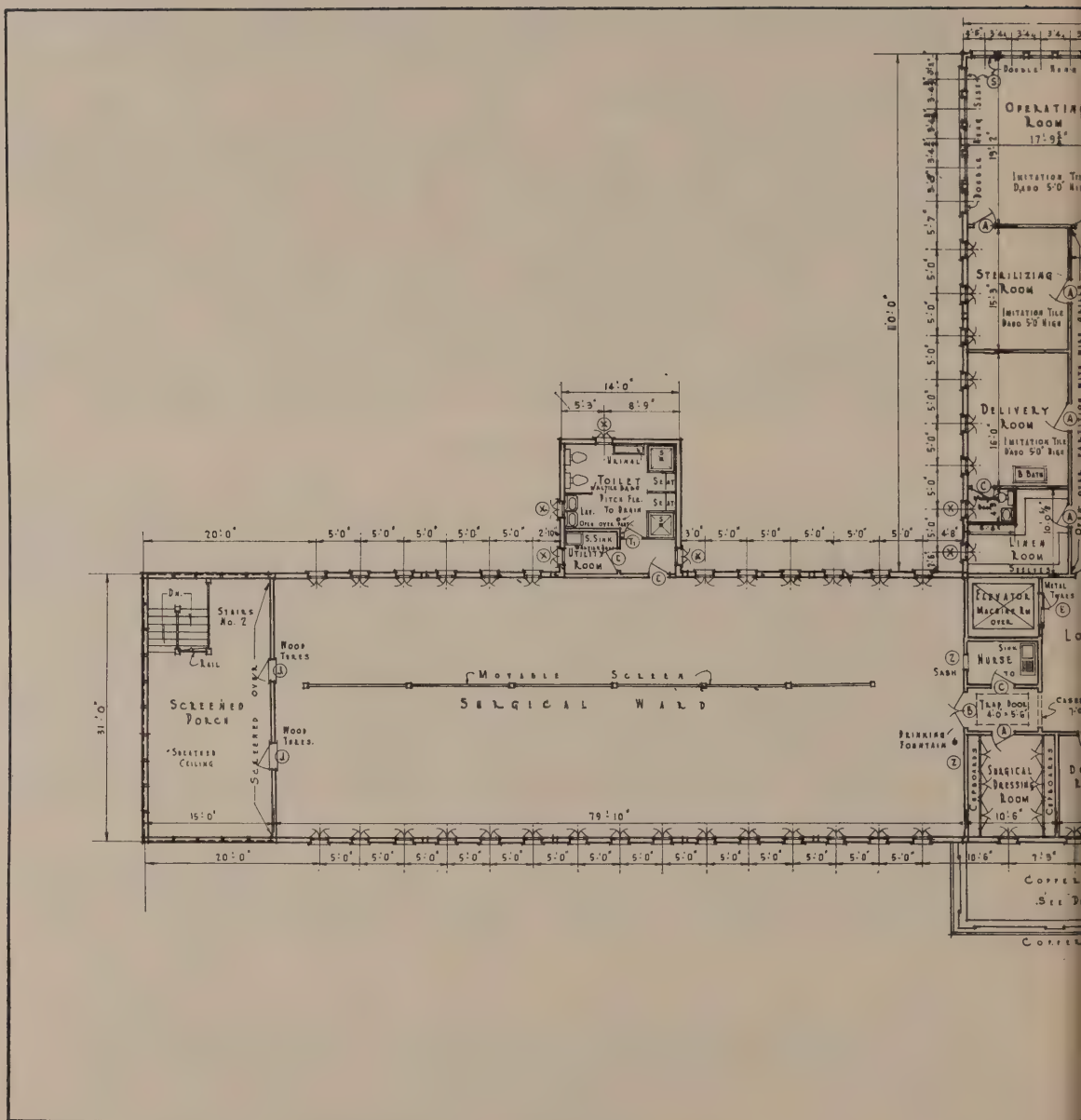
MALARIA IN LEGAL MEDICINE—CASES IN RELATION TO ACCIDENTS

RICARDO AQUILAR, M.D.

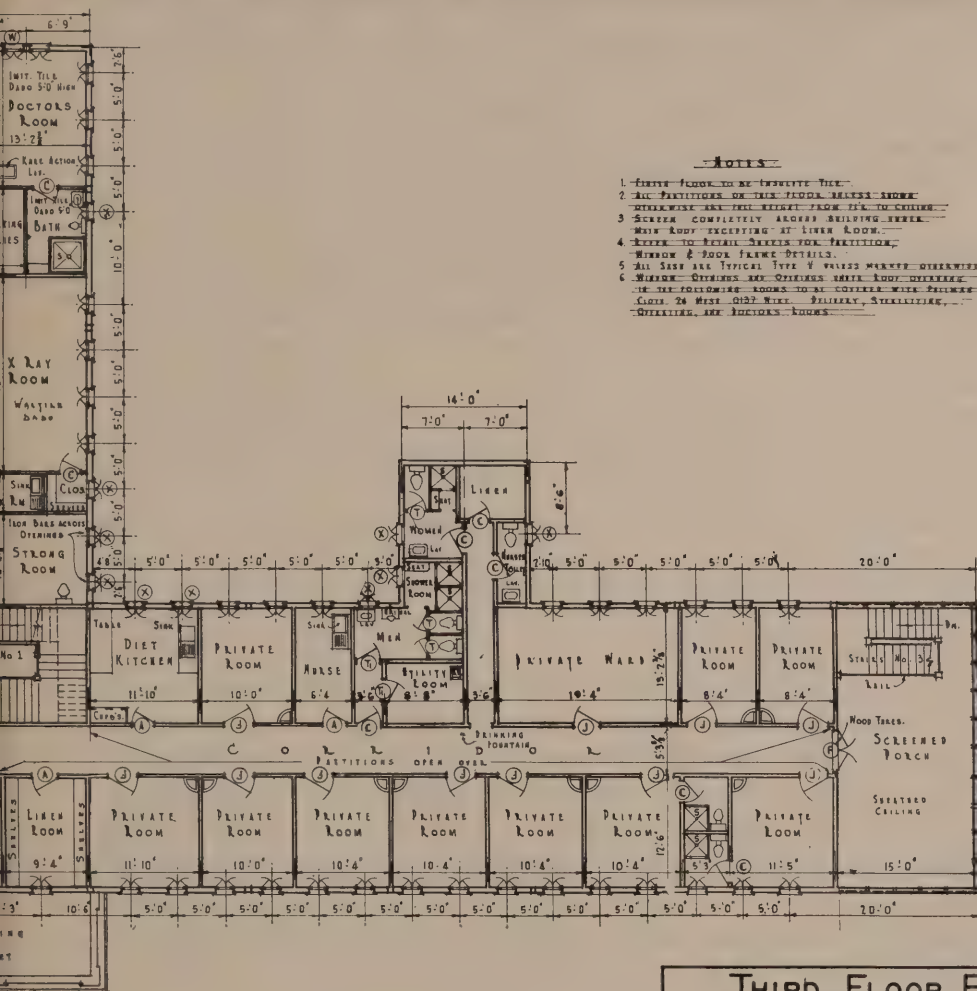
United Fruit Company Hospital

Quirigua, Guatemala

Certain Diseases in Relation to Accidents.—Experience has taught employers of labor to take into consideration various conditions such as alcoholism, epilepsy, syphilis, diabetes, nephritis, etc., as causes for rejection, particularly in



THIS SKETCH HAS BEEN REDUCED TO APPROXIMATELY TWO-FIFTHS OF THE SIZE OF



THIRD FLOOR PLAN HOSPITAL

PUERTO ARMUELLES

PANAMA

CHIRIQUI LAND CO.

ENGINEERING DEPT.

BOSTON, MASS.

APPROVED

H. Roine

DRAWN BY JOC-JFF

CHECKED BY JFF

CORRECT *CRS*

SCALE $\frac{1}{8}'' = 1'-0''$
DATE: DEC. 26, 28.

FILE NO. 3080
SH. NO. A-3

ORIGINAL BLUEPRINTS, AND SCALES SHOWN MUST BE MODIFIED ACCORDINGLY

filling positions where danger and responsibility are involved. Any of these conditions may be responsible for temporary mental aberrations or loss of consciousness, and may thus be a contributing factor in serious loss of life and property.

Malaria Important as Potential Cause of Accidents.—In this connection, malarial infections have not been considered, but at times, as shown by the following case report, it may be responsible for serious accidents with subsequent damage suits and unjust penalties against employers of labor who are in no way responsible. In many such cases the individual employees are at fault, and not the employer. When an employer provides an employee with every known means to prevent malarial infection, and the necessary agents and instructions for his cure, the employer should not be held responsible for the neglect of the employee who refuses to profit by the instructions given him.

In all cases in which accidents occur, a careful physical examination should be made of each individual involved in its probable cause. The physical examination should be supplemented by complete laboratory findings on the blood, urine, and possibly the spinal fluid, in order that a full report with diagnosis may be furnished the judge, to enable him to reach a just conclusion and fix responsibility.

Two Types of Cases.—The proneness of malaria infection to produce delirium and other cerebral conditions whereby consciousness is lost and responsibility ceases, places this disease in a category similar to that of alcoholism, epilepsy, diabetes, etc. There are two types of these cases: One is the type in which cerebral malaria deranges the mentality of an employee and thus contributes to the cause of an accident; another type includes those cases of accidental trauma in which, on account of a severe exacerbation of a latent malaria infection, the severity of the symptoms, or even death, in an individual case may be attributed to the accident when, in reality, it is due to malaria which may be recognized, or may not unless the attending surgeon realizes the possibility and takes smears to verify or exclude the presence of a coexisting malaria infection. The former type is well illustrated by the following case report:

CASE REPORT

History.—O. F., native, aged 19 years, admitted to the Hospital on May 14, 1927. The patient had had fever for 2 days. While on duty as fireman on a special train, he had suddenly developed a chill, followed by a severe attack of fever. In Gualan (a small railroad station on the line) the engineer of the train went to lunch, and the fireman without orders started the engine and ran the train on. Fortunately other members of the train crew succeeded in reaching the engine and stopping it at the next station. The fireman was arrested, but later was brought to the Hospital when the authorities found that he was suffering from high fever.

Luckily no harm came of this incident, although it might have been the cause of a serious wreck as the fireman had taken his train out of the station without *via* (right of way) or orders from the train dispatcher.

Examination.—On admission to the Hospital, the patient was delirious. Examination showed that his *temperature* was 103°, *pulse* 96, and *skin* pale, with profuse perspiration. *Tongue* was coated, *liver* tender, *spleen* palpable and tender. *Blood* was positive for E. A. malaria parasites.

Diagnosis.—E. A. malaria (cerebral type).

Treatment and Results.—After 2 days' treatment with 8 minims of adrenalin solution subcutaneously and 15 grains of quinine hydrochloride intramuscularly given twice a day, the temperature became normal and there was complete relief from symptoms.

THE BLOOD IN BLACKWATER FEVER¹

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My studies in blackwater fever are being carried out along two lines: Epidemiological Studies, and Laboratory Studies; and some points in the epidemiological studies have already been reported. As the epidemiological study came down to the individual, it naturally led to the laboratory studies; and the blood is one of the most important studies here. This study consists of typing, coagulation time determinations, studies of the blood picture, tests of the resistance of the red blood cells to hypotonic salt solution, saponin, and cobra venom, tests for hemolysins and quinine hemolysis, and blood chemistry determinations. The study of the malarial parasites will be reported at another time.

RACE

All of the cases studied were Cubans, except one Cuban mulatto and one Barbadian.

TYPING

The scant reports of blood typing in blackwater fever have indicated that there is no relation between blood type and susceptibility to the condition. The few typings I have made are set down in Tables I and Ia² (pages 124 and 125).

¹ The report of the 1927 work was read at the twenty-fourth annual meeting of the American Society of Tropical Medicine, Washington, D. C., May 2, 1928.

² The "a" tables are tabulations of the 1928 work.

FLOCCULATION TEST

The Kahn test was used in my work, a number of sera being tested by the Meinicke test by the hospital pathologist. The results of the Kahn test are set down in Tables I and Ia. Positives occur in the subjects and controls as well as in the cases, and probably these positive ones are syphilitic.

TABLE I

	Race	Stage of Blackwater	Color of Serum	Coagulation Time	Kahn Test	Type*
Cases						
1	Cuban	Convalescent	yellow	1 $\frac{1}{4}$ min.	negative	II
2	Cuban	1" day	yel. brown	1 $\frac{3}{4}$ min.	pos.: 4+	I
3	Cuban	2" day urine clear	lt. straw	0	negative	I
4	Cuban	1" day	brownish yellow	0	negative	I
5	Cuban	1" day	0	0	0	0
6	Cuban	pre-black- water	yellow	0	negative	I
7	Cuban	1" day	yel. green	2 $\frac{1}{4}$ min.	negative	I
8	Cuban mulatto	3" day	mahogany	1 $\frac{1}{2}$ min.	pos.: 4+	I
9	Cuban	1" day	0	1 min.	0	0
10	Barbadian	3" day	mahogany	1 $\frac{1}{4}$ min.	negative	II
11	Cuban	1" day	0	1 min.	0	I
12	Cuban	2" day	0	2 $\frac{1}{4}$ min.	0	0
13	Cuban	1" day	0	0	0	0
Subjects						
14	Cuban	0	lt. yel.	2 $\frac{1}{4}$ min.	negative	II
15	Cuban	0	straw	0	negative	II
16	Cuban	0	straw	0	pos.: 4+	II
17	Cuban	0	0	2 $\frac{1}{2}$ min.	0	0
18	Cuban	0	straw	2 $\frac{1}{4}$ min.	pos.: 4+	II
19	Cuban	0	yellow	3 min.	negative	I
20	Cuban	0	straw	2 min.	negative	II
21	Cuban	0	0	1 $\frac{1}{2}$ min.	0	0
22	Cuban	0	0	1 $\frac{1}{2}$ min.	0	0
23	Cuban	0	0	1 min.	0	0
Controls						
24	Cuban	0	yellow	2 min.	negative	I
25	Cuban	0	0	1 $\frac{1}{2}$ min.	0	0
26	Cuban	0	lt. straw	2 min.	pos.: 4+	I
27	Cuban	0	0	1 min.	0	0
28	Cuban	0	yellow	1 $\frac{1}{4}$ min.	negative	0
29	Cuban	0	0	1 $\frac{3}{4}$ min.	0	0
30	Cuban	0	0	2 min.	0	0

* Jansky.

0 means test not made.

TABLE Ia

	Race	Stage of Blackwater	Color of Serum	Coagulation Time	Kahn Test	Type*
Cases of bw.						
‡ 1018 G. B.	Cuban	conval.	yellow	0**	—	0
‡ 1092 A. R.	Cuban	1" day	yellow	0	0	I
‡ 1105 A. P.	Cuban	1" day	dark yellow mahog. tinge	0	—	I
‡ 1186 A. G.	Cuban	1" day	brownish yellow	0	—	II
Malaria in bw. subjects						
‡ 1073 G. B. same as ‡ 1018	Cuban	0	yellow	0	0	0
‡ 1117 R. G.	Cuban	0	yellow	0	—	II
Malaria Con- trol not bw. subject ‡ 1100 R. C.	Cuban	0	yellow	0	0	0

* Jansky.

** Every case runs through all tables, even though only part of the tests were done on any individual case.

COAGULATION TIME

The coagulation time was determined by the capillary tube method, taking the blood in the tube after blood for smears had been taken from the puncture. In no case was there any disturbance in coagulation time. The results of these determinations are set down in Table I. Further determinations will be carried out by taking the blood in the tube as soon as the puncture is made.

RESISTANCE OF THE RED BLOOD CELLS

Resistance to Hypotonic Salt Solution.—In these determinations, the regular technique was followed, using tubes of salt solution varying in strength from 0.5 per cent. down to 0.30 per cent., the strengths differing by 0.02 per cent. between each tube and the next. A measured quantity of washed red blood cells was dropped into each tube, or a measured quantity of blood was added to each tube direct from an ear puncture. The tubes were incubated at 37°C for one

hour, and allowed to stand at room temperature for two hours, and then read. When fresh cells were washed and used at once, or when fresh blood was dropped directly into the tubes, there was no difference in the resistance of the red cells of the cases and those of the controls. The results of these tests are set down in Tables II and IIa (pages 129, 130 and 131).

The earlier tests showed the importance of using fresh cells for the test, as allowing the cells to stand in the ice box, even over night, lowered the resistance of the cells.

Objection has repeatedly been made to the use of hypotonic solutions of sodium chloride alone in determining the resistance of red cells, as sodium chloride increases the permeability of the cell membrane, while other salts (as calcium salts) decrease it. So it has been advised to use a series of hypotonic solutions corresponding as nearly as possible to the ionic content of the blood plasma.

Another objection that has been made to the usual way of carrying out the test, is that it is difficult to determine where hemolysis begins and where it ends.

Simmel¹ devised a solution and a technique that meet both of these objections. His standard solution approximates very closely the ionic composition of the blood plasma. This solution is isotonic with the whole blood, is buffered to the same degree, and contains the same salts in approximately the same amounts as they are present in the blood.

In making the test, a red cell count is made in the regular way, using the standard solution as the diluting fluid. At the same time, four solutions are prepared, containing 70, 60, 50, and 40 per cent. of the standard solution, and made up to volume with distilled water. Blood is drawn into red cell counting pipettes, diluted with these hypotonic solutions, allowed to stand at room temperature for one hour, and the red cells counted in the usual way. These counts are reduced to percentages of the number of red cells in the patient's blood in the undiluted standard fluid, and plotted as a curve, with the ordinate as percentage of resistant cells, and the abscissa as percentage of the standard fluid in the diluting fluid. The curve is checked against the curves of a series of normal bloods as controls.

I hesitated to use Simmel's method, for two reasons: (1) it is somewhat complicated and time consuming, and (2) the large number of ghosts of red cells in the blood of blackwater fever cases makes accurate counting rather difficult at the height of the process.

So, it was a satisfaction to me, while in Cuba in the summer of 1928, to receive the journal containing Ross's² article. He used the Simmel method in testing the fragility of the red blood cells in cases of blackwater fever, and got no appreciable change from the normal curve of red cell resistance to hypotonic salt solution. Ross suggests that, in spite of there being no evidence of decreased

1. Simmel, H., "Die osmotische Resistenz der Erythrocyten," *Deut. Arch. f. klin. Med.*, 1923, 142, 252

2. Ross, G. R., "Erythrocyte fragility test," *Ann. Trop. Med. and Parasitol.*, 1928, 22, 5

resistance of the red cells in the peripheral blood, the hemolysis may take place in the spleen, as a result of the accumulation of injured red cells there; as the spleen seems to act as a selective filter, infected and injured red cells being filtered out there.

Resistance to Saponin.—For these determinations, dilutions of saponin from 1:35,000 to 1:46,000 were used, and measured quantities of fresh washed red cells were added to each tube. The tubes were incubated at 37°C for one hour, and a preliminary reading was made: the tubes were then left in the refrigerator over night, and the final reading made in the morning. There was no difference in the resistance of the red cells of the cases or subjects and those of the controls. The results of these tests are set down in Table II (pages 129 and 130).

Resistance to Cobra Venom.—For these determinations, dilutions of cobra venom of 1:10,000, 1:15,000, 1:20,000, 1:30,000, and 1:40,000 were used. A measured quantity of fresh washed red cells was added to each tube, incubated at 37°C for one hour, a preliminary reading made, the tubes placed in the refrigerator over night, and the final reading made in the morning. There was no difference in the resistance of the red cells of the cases or subjects and those of the controls. The results of these tests are set down in Table II.

It has been suggested that, in paroxysmal hemoglobinuria, the mechanism of hemolysis is similar to the mechanism of hemolysis by cobra venom. These tests do not indicate that the mechanism of hemolysis in blackwater fever is of the nature of the mechanism of hemolysis by cobra venom, or that the red cells in blackwater fever are altered in their resistance to cobra venom.

TESTS FOR SERUM HEMOLYSINS AND QUININE HEMOLYSIS

Serum Hemolysins.—Patient's serum (0.2 ml. and 0.1 ml. quantities) measured quantities of patient's red cells, with guinea pig complement, was placed in the refrigerator for one hour, then incubated at 37°C for two hours, centrifuged, and the reading made. Controls consisted of patient's serum in the same quantities, normal red cells, and guinea pig complement; normal serum with patient's and normal red cells, and guinea pig complement; and a red cell suspension in guinea pig complement and in physiological salt solution. The serum of the cases and subjects showed no difference from the serum of the controls, in its action on the patient's red cells or on normal red cells. The results of these tests are set down in Table II.

Weil and Stieffel¹ call attention to the fact that in the Donath and Landsteiner technique, it is necessary to take the blood and manipulate it at 37°C.; not allowing the serum to cool until it is put in the cold for sensitizing the red cells. They also advise not to leave the serum-red cell mixture too long in the cold, as it destroys the hemolysin; and they advise shaking the tubes on removal from the cold, before putting in the incubator. They advise the use of as little salt solu-

1. Weil, P. E., and Stieffel, R., "Étude analytique et critique de la réaction de Donath et Landsteiner," *Sang*, 1927, 1, 123

tion as possible, as even isotonic salt solution destroys the hemolytic property of the serum.

In my work in 1927, the blood was drawn and manipulated with no attempt to prevent its being cooled to room temperature. Following the advice of Weil and Stieffel, in 1928 I was very careful to keep the blood and the separated serum warm until the serum-red cell mixture was put in the cold for sensitization of the red cells; and the serum-red cell mixture was put in a salt and ice mixture at 0°C for 15 minutes. In one set of tests, the complement (fresh guinea pig or human serum) was added with the sensitizing serum; and, after the 15 minutes in the cold, the tubes were shaken and put in the incubator for two hours. Duplicate tests were set up: I put the sensitizing serum in the tube with the cells, put the tubes in the cold for 15 minutes, centrifuged, decanted the supernatant serum, washed in a small amount of physiological salt solution at 0°C, decanted the supernatant salt solution, added the complement, shook the tubes, and placed them in the incubator for two hours. There was no difference in the results of the two methods of carrying out the test, and the results are tabulated in Table IIa (page 131).

Ehrlich's test for serum hemolysins was used on two persons: a convalescent case, and a blackwater subject. In both persons, no difference in the sera from the two sides could be detected by the naked eye, and no hemoglobin was shown in any of the sera by the spectroscope or by the benzidine test.

Quinine Hemolysis.—The question regarding the part played by quinine in blackwater fever makes it important to consider whether quinine exerts any hemolytic action on the red cells of cases and subjects of blackwater fever. There are several reports of quinine exerting a hemolytic action on red cells; but most of these reports are rather vague and indefinite, or are mere statements that quinine has such an action. In a recent report¹ of the hemolytic action of quinine, it appears that the investigator was really testing the resistance of the red cells to hypotonic salt solution, and could have expected to obtain the same results without the addition of quinine to his solutions.

The tests for quinine hemolysis were conducted in the same way as were the tests for serum hemolysins, with the same controls, with the modification that enough quinine hydrochloride was added to the diluting fluid to give a quinine hydrochloride dilution of 1:2,000 in the completed tubes. Incubation and reading were the same as with the tests for serum hemolysins. In no case was there any indication that quinine hydrochloride in this concentration exerted any hemolytic action, either in mixtures of serum and red cells, or in mixtures of red cells and salt solution. The results of these tests are set down in Table II.

In two convalescent cases, 0.2 ml. of a 1:1000 solution of quinine hydrochloride was injected intradermally. There was no reaction of any kind—injection into my own skin as control:

1. Voinik, A.: "The Resistance of Erythrocytes to Quinine," *Profilakticheskaya Meditsina*, 1927, 6, 20

TABLE II

	Resistance of Red Blood Cells*			Hemolysis	
	Hypotonic Salt Solution	Saponin	Cobra Venom	Patient's Serum, Red Cells and Complement	Serum, Red Cells, Compl. and Quinine to Make a 1:2000 Sol.
Cases					
1.	Beg. hemol.: 0.5 C: beg. hemol.: 0.46	MH6, SH6 C: MH4, SH8	H, H, MH, SH, SH C: H, H, H, H, MH	negative C: neg.	negative C: neg.
2.	Beg. hemol.: 0.5 C: beg. hemol.: 0.46	H12 C: MH4, SH8	H, MH, MH, SH, SH C: H, H, H, H, SH	negative C: neg.	negative C: neg.
3.	Beg. hemol.: 0.5 compl.: 0.36 C: beg. hemol.: 0.44 not compl.: 0.32	H4, MH8 C: H3, MH9	SH, -, -, -, - C: MH, MH, MH, SH, SH	negative C: neg.	negative C: neg.
4.	0	0	0	negative C: neg.	negative C: neg.
5.	0	0	0	0	0
6.	Beg. hemol.: 0.5 compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32 **Beg. hemol.: 0.42 compl.: 0.28	MH12 C: MH6, SH6	H, H, MH, MH, SH C: H, H, H, MH, SH	negative C: neg.	negative C: neg.
7.	Beg. hemol.: 0.46 not compl.: 0.32 Unwashed cells: Beg. hemol.: 0.4 not compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32	MH6, SH6 C: MH4, SH8	H, H, H, MH, SH C: H, H, H, MH, SH	negative C: neg.	negative C: neg.
8.	Beg. hemol.: 0.44 not compl.: 0.32 Unwashed cells: Beg. hemol.: 0.36 slt in: 0.32 C: beg. hemol.: 0.46 not compl.: 0.32	SH12 C: MH4, SH8	MH, MH, SH, SH, SH C: H, H, H, MH, SH	negative C: neg.	negative C: neg.
9.	0	0	0	0	0
10.	Beg. hemol.: 0.5 not compl.: 0.32 C: beg. hemol.: 0.46 not compl.: 0.32	0	0	negative C: neg.	negative C: neg.
Sub- jects					
14.	Beg. hemol.: 0.5 C: beg. hemol.: 0.46	MH1, SH11 C: MH4, SH8	H, H, H, H, MH C: H, H, H, H, MH	negative C: neg.	negative C: neg.
15.	Beg. hemol.: 0.48 C: beg. hemol.: 0.46	H12 C: MH4, SH8	H, H, MH, SH, SH C: H, H, H, H, MH	negative C: neg.	negative C: neg.
16.	Beg. hemol.: 0.48 compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32	MH12 C: MH4, SH8	MH, SH, SH, SH, SH C: MH, MH, MH, SH, SH	negative C: neg.	negative C: neg.

TABLE II—*Concluded*

	Resistance of Red Blood Cells*			Hemolysis	
	Hypotonic Salt Solution	Saponin	Cobra Venom	Patient's Serum, Red Cells and Complement	Serum, Red Cells, Compl. and Quinine to Make a 1:2000 Sol.
Sub-jects					
18.	Beg. hemol.: 0.48 nearly compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32	MH12 C: MH10, SH2	SH, SH, SH, —, — C: MH, MH, MH, SH, SH	negative C: neg.	negative C: neg.
19.	Beg. hemol.: 0.42 not compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32	MH12 C: MH10, SH2	H, H, MH, SH, SH C: H, H, MH, SH, SH	negative C: neg.	negative C: neg.
20.	Beg. hemol.: 0.44 not compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32	MH12 C: MH10, SH2	H, H, MH, SH, SH C: H, H, MH, SH, SH	negative C: neg.	negative C: neg.
Con-trols					
24.	Beg. hemol.: 0.46 nearly compl.: 0.32 C: beg. hemol.: 0.44 no compl.: 0.32	MH12 C, H3, MH9	MH, MH, MH, SH, SH C: MH, MH, MH, SH, SH	negative C: neg.	negative C: neg.
26.	Beg. hemol.: 0.48 compl.: 0.38 (cells over 24 hrs. old) C: beg. hemol.: 0.44 not compl.: 0.32	MH12 C: H3, MH9	H, H, H, H, H C: H, H, H, H, MH	negative C: neg.	negative C: neg.
28.	Beg. hemol.: 0.46 compl.: 0.32 C: beg. hemol.: 0.44 not compl.: 0.32	MH12 C: H3, MH9	H, H, MH, SH, SH C: H, H, MH, SH, SH	negative C: neg.	negative C: neg.

Note: Beg. = beginning hemolysis; C = control; H = complete hemolysis; MH = moderate hemolysis; SH = slight hemolysis; — = no hemolysis. Abbreviations in the Cobra Venom test correspond to the 5 tubes used in that test. The numbers in the Saponin test refer to the tubes in which hemolysis occurred of the degree indicated by the respective abbreviations (MH, SH, etc.) before the numbers.

* All tests with washed cells unless otherwise stated.

** During convalescence. Blood added directly from puncture to salt tubes.

TABLE IIa

Cases of bw.	Resistance of Red Blood Cells to Hypotonic Salt Solution	Hemolysis		
		Patient's Serum, Red Cells and Complement	Patient's Serum, Red Cells, Compl. and Quinine to Make a 1:2000 Sol.	Patient's Red Cells and Quinine to Make a 1:2000 Solution
# 1018 G. B.	0	0	0	0
# 1092 A. R.	Beg. hemol: 0.42 Complete: 0.30 C: Beg. hemol: 0.44 Complete: 0.30	Negative C: Negative	Negative C: Negative	Negative C: Negative
# 1105 A. P.	Beg. hemol: 0.44 Not compl: 0.32 C: Beg hemol: 0.44 Complete: 0.30	Negative C: Negative	Negative C: Negative	Negative C: Negative
# 1186 A. G.	lost	Negative C: Negative	Negative C: Negative	Negative C: Negative
Malaria in bw. sub- jects				
# 1073 G. B. Same person as # 1018	Beg. hemol: 0.44 Complete: 0.30 C: Beg. hemol 0.44 Complete: 0.30	Negative C: Negative	Negative C: Negative	Negative C: Negative
# 1117 R. G.	Beg. hemol: 0.42 Complete: 0.30 C: Beg. hemol: 0.44 Complete: 0.30	Negative C: Negative	Negative C: Negative	Negative C: Negative
Malaria not a bw. subject				
# 1100 R. C.	0	0	0	0

THE BLOOD PICTURE

A study of the blood picture of a severe case is tabulated in Table III, herewith

TABLE III

CASE: S. T. ADMITTED: JUNE 27, 1927. BLACKWATER BEGAN JUNE 29, 1927

Day of Black-water	Red Blood Cells ¹		Leukocytes	
	Count	Stained	Total Count	Differential
2"	0	3	9,400	lympho.: 19 lge. mono.: 4 Neutro.: 76 (3 myelocytes) ¹⁰ baso.: 1
3"	0	4	6,000	lympho.: 17 lge. mono.: 5 neutro.: 78 (2 myelocytes)
4" urine clear	0	5	9,600	lympho.: 18 lge. mono.: 10 neutro.: 71 broken: 1 (1 myelocyte)
5"	1,127,000 ²	0	0	0
6"	0	6	16,700	lympho.: 16 lge. mono.: 13 neutro.: 69 (3 myelocytes) broken: 2
8"	0	7	18,000	0
10"	2,700,000	0	0	0
13"	0	8	4,600	lympho.: 31 lge. mono.: 4 neutro.: 60 eosino.: 1 broken: 4
14"	4,500,000	0	0	0
20"	0	9	5,800	lympho.: 39 lge. mono.: 4 neutro.: 53 eosino.: 3 broken: 1

(For references, see page 133)

BLOOD CHEMISTRY

I was not equipped to do blood chemistry determinations on the trip in 1927, so I tried preserving whole blood with 20 mgms. of sodium fluoride per ml. and carrying it back to Washington for study here. Sera were placed in ampoules and carried back here for study. The results of the study of these bloods and sera are set down in Table IV (page 134) and show that it is not possible to get satisfactory results from determinations on such material when kept for a period of several months. Creatine and chloride determinations were not made; and, as the non-protein nitrogen figures are already known to be very high, and the sugar to fall off markedly, under such long preservation, the results of these determinations are not included in the table. It is interesting that the urea is preserved very well under these conditions, and the lipoids—a very important study, in view of the suggestions that the lipoids play a very important part in the hemolysis in blackwater fever—were preserved quite well. It is hard to account for the low figures in the total phosphorus determinations. The entire table is presented, partly to show the findings in some substances that were preserved quite well, and partly to show that such long preservation is not entirely satisfactory for blood and sera that are to be studied chemically.

In the studies in 1928, the non-protein nitrogen, urea, uric acid, creatinine and sugar determinations were made as soon as the blood was taken; the alcohol-ether extracts for cholesterol and lecithin were made promptly, evaporated to dryness, and these dried residues were carried to Washington and the determinations made there. The trichloroacetic acid filtrates of the sera were carried to Washington, where the calcium and inorganic phosphorus determinations also were made; and whole blood was carried to Washington and the total phosphorus determinations were made there. The results of the 1928 determinations are set down in Table IVa.

-
1. Blood negative for malarial parasites on entering hospital, and during stay in hospital. Positive for sub-tertian gametocytes in a survey, three or four days before entering hospital.
 2. Red cells difficult to count, because of presence of debris and shadows of red cells, and clumping in the diluting fluid. Still some clumping on the tenth day.
 3. Marked anisocytosis and polychromatophilia. Numerous shadows of red cells, but no nucleated reds.
 4. As on second day.
 5. As on second day.
 6. Numerous nucleated reds of all types.
 7. Same as on sixth day.
 8. Anisocytosis still present. Marked polychromatophilia. Marked basophilic stippling. Numerous Cabot's rings and semi-lunar bodies. Very few nucleated reds.
 9. Still anisocytosis—microcytes. Polychromatophilia less pronounced. No nucleated reds.
 10. Neutrophile myelocytes—included in the neutrophile percentage.

TABLE IV

[illegible]

TABLE IVa

	Condition of Urine	Mgm. in 100 Ml. Whole Blood								Mgm. in 100 Ml. Serum	
		Non-protein Nitrogen	Urea Nitrogen	Uric Acid	Creatinine	Sugar	Cholesterol	Lecithin	Total Phosphorus	Calcium	Inorganic Phosphorus
Cases of bw.											
#1018 G. B.	on admis. hgbn. +++ normal at time of bld. exam.	19 days after adm. 0	0	2.5	1.76	115	233	269	33.8	12.7	22.2
#1092 A. R.	red hgbn. ++ r.b.c. ++ scant a.m.	17.68	12.28	3.2	1.7	82	225	245	34.1	13.5	0
#1105 A. P.	dk. mahog. hgbn. +++ r.b.c. — reduced	lost	29.6	lost	1.68	130	199	245	31.25	14.6	10.4
6 days later	normal	lost	0	0	0	131.7	0	0	0	0	0
#1186 A. G.	mahog. red hgbn. ++ r.b.c. — normal amt.	26.79	12.35	2.13	1.58	77.32 duplicate 77.72	188	265	lost	13.8	11.1
Malaria in bw. subjects											
#1073 G. B.	normal scant	34.1	18.74	0	0	83.8	0	0	0	0	0
Same person as #1018											
#1117 R. G.	clear scant	lost	17.51	5.66	1.74	70	184	278	32.5	11.2	16.4
2 days later	normal	0	0	0	0	156	0	0	0	0	0
Malaria not in bw. subject											
#1100 R. C.	clear scant	40.0	23.5	3.7	1.53	94	170	255	29.5	13.0	13.5

It is well understood that the determinations of inorganic phosphorus give too high figures when the determination is delayed; and that is evidently the case here: however, the figures for inorganic phosphorus are included in the table. The high figures for calcium cannot be explained at present. In 1927 it was

necessary to use ordinary lime glass tubes for carrying the sera; but in 1928, ampoules of high-grade alkali-free glass were used for preserving the trichloroacetic acid filtrates. In future work, an attempt will be made to determine the calcium and inorganic phosphorus promptly after the sera are separated from the clot.

Carbon Dioxide Combining Power of the Blood Plasma.—In observing a case of paroxysmal hemoglobinuria, Berghausen¹ noted that the blood serum was laked when blood was obtained for a Wassermann by constriction above the elbow—producing passive congestion. He studied the hemolytic action of carbon dioxide, and studied the salts in the blood; and from this study he suggested that cold, trauma, and passive congestion, which lead to an attack of hemoglobinuria, may be associated with the production of an excessive acidity in the tissues, and that the organic acids thus formed may play a part in the hemolytic process. Even though a specific hemolysin is back of the process, the acidosis possibly is an additional factor acting locally.

Applying this idea to blackwater fever, I considered it advisable to test the blood of cases, to determine whether there was an association of "acidosis" in this condition. Since, owing to the action of buffers in the blood, the hydrogen ion concentration of the blood does not change until the acidosis is very severe, it was deemed advisable to use a test which measures the alkali reserve of the blood; and the determination of the carbon dioxide combining power of the blood plasma is the most reliable test for that purpose.

Accordingly, in the spring of 1928 I carried with me a Van Slyke blood gas apparatus; and had opportunity to determine the carbon dioxide combining power of the blood plasma in two cases of blackwater fever, as follows:

Case No. 1105. A. P. Cuban. Male. 21 years old. A typical case of blackwater fever of moderate severity, of a few hours' duration on entering the hospital, and which persisted for 36 hours in the hospital, and ended in recovery. There was no vomiting; the temperature was 104°F.; the blood was negative for malarial parasites; the urine was scant, dark mahogany color, with hgbn. + + +, no red blood cells. The carbon dioxide combining power of the plasma was determined at 5:00 P.M., with the barometer at 30.25 inches, and the room temperature 32.3°C. The gas volume was 0.57 ml. According to the usual method, for clinical purposes, of subtracting 0.12 from the reading (and multiplying by 100), this gives 45 ml. of carbon dioxide liberated from 100 ml. of plasma.

Case No. 1092. A. R. Cuban. Female. 18 years old. A mild case of blackwater fever, of a few hours' duration on entering the hospital, and which persisted for one day in the hospital, and ended in recovery. There was no vomiting; the temperature was 99.5° F. at the time the blood was taken; the blood was negative for malarial parasites; the urine had been scant, but was being excreted freely at the time the blood was taken, red, hemoglobin +, red cells + + (patient not menstruating). The carbon dioxide combining power of the blood plasma was determined at 3:00 P.M., with the barometer at 30.25

1. Berghausen, "The Rôle of Acidosis of the Tissues as a Factor in the Production of an Attack in Paroxysmal Hemoglobinuria," *Arch. Int. Med.*, 1912, 9, 137

inches, and the room temperature 31° C. The gas volume was 0.6 ml. According to the usual method, for clinical purposes, of subtracting 0.12 from the reading (and multiplying by 100) this gives 48 ml. of carbon dioxide liberated from 100 ml. of plasma.

It is generally agreed that a figure below 50 ml. in adults indicates acidosis; so we see that in both cases there is a mild acidosis, slightly more in the typical case than in the mild case. But, if we must go below 30 ml. before we have a severe acidosis, we see how mild is the acidosis in these two cases. Indeed, Dr. Roe tells me that he gets figures as low as these in the routine examination of medical students in class work here in Washington. The study will be continued this summer, and in subsequent work, and controls will be tested, with the idea of accumulating more information on this point.

On my return to Washington in the fall, I came across the interesting paper by Blacklock and Macdonald.¹ It is known that as a result of deficient oxidation, sarcolactic acid accumulates in the muscles and is increased in amount in the peripheral blood. In excessive exercise there may be as much as 0.45 per cent. in the muscles, and 0.2 per cent. (200 mgm. in 100 ml. of blood) in the peripheral blood. As the normal amount of lactic acid in the peripheral blood is about 20 mgms. per 100 ml. of blood, this is a nine-fold increase in the amount of lactic acid in the peripheral blood. They suggest that this increased amount of lactic acid is the hemolytic agent in blackwater fever.

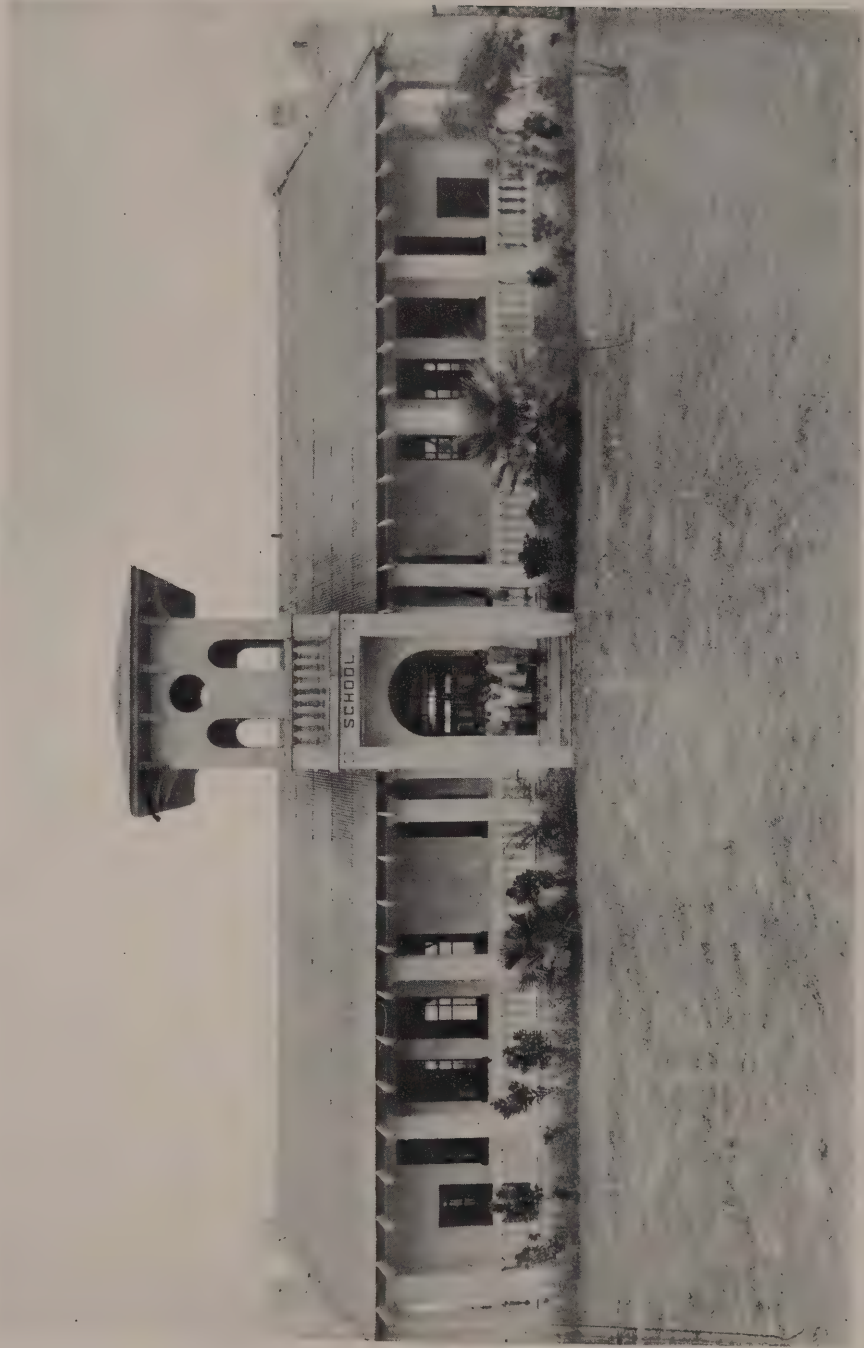
It appears that this mechanism might well be back of some of the cases of March Hemoglobinuria, especially if that is a myoglobinuria.² But the two observations reported here do not tend to indicate that this is the mechanism of malarial hemoglobinuria. If we do consider this acidosis as a factor in the production of hemolysis, we still have to agree with Berghausen that it is only an additional factor to some other specific factor, since by no means all cases of excessive exercise, or of acidosis, no matter how severe, have hemoglobinemia or hemoglobinuria.

REMARKS

No conclusions are drawn, and no suggestions are made. It is recognized that more material must be collected before one is justified in making any suggestions. The work is in progress; and this is merely a progress report.

1. Blacklock, D. B., and Macdonald, G., "The Mechanism of Blackwater Fever and Certain Allied Conditions," *Brit. Med. Journ.*, 1928, 2, 145

2. Whitmore, E. R., "Hemoglobinemia and Hemoglobinuria," *Phi Chi Quarterly*, 1929, 26, 435



TRUXILLO RAILROAD COMPANY SCHOOLHOUSE IN PUERTO CASTILLA, HONDURAS



UNITED FRUIT COMPANY SCHOOLHOUSE IN THE PANAMA DIVISION



RESIDENCE OF DISTRICT MEDICAL OFFICER IN BANES DIVISION (CUBA)



NURSES' QUARTERS, UNITED FRUIT COMPANY, BANÉS, CUBA



FIELD DISPENSARY OF THE UNITED FRUIT COMPANY IN THE COLOMBIA DIVISION



FIELD DISPENSARY OF THE UNITED FRUIT COMPANY IN THE PANAMA DIVISION



QUARTERS OF UNITED FRUIT COMPANY LABORERS AT ALMIRANTE, PANAMA



TYPICAL FARM LABORER'S HOUSE IN THE BANES DIVISION (CUBA) SHOWING CENTRAL DRAINAGE DITCH
AND RESIDENT'S GARDEN



TYPICAL FARM SUPERINTENDENT'S RESIDENCE, WITH SCREENED WATER TANK IN THE FOREGROUND



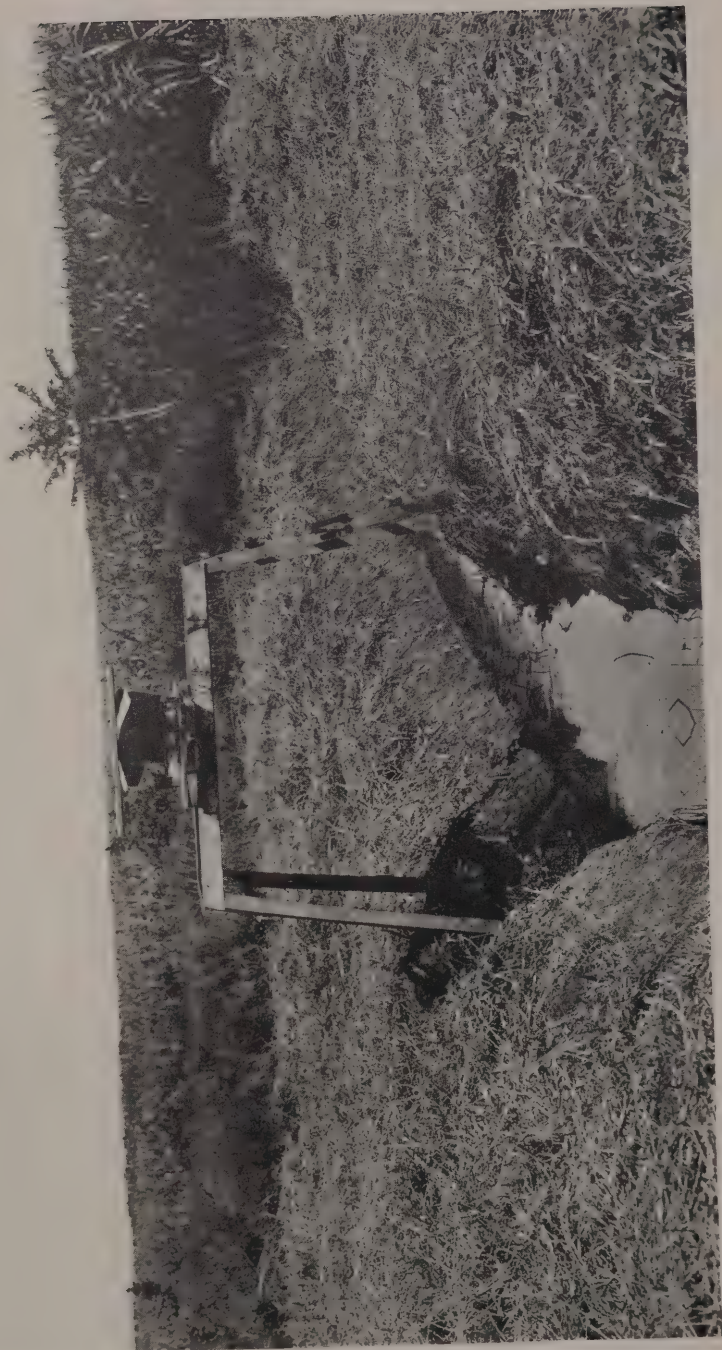
VILLAGE FOR FARM LABORERS' IN THE BANOS DIVISION (CUBA), IN PROCESS OF CONSTRUCTION. EACH FAMILY IS ALLOTTED A PLOT OF GROUND FOR GARDENING



METHOD OF DISTRIBUTING PARIS GREEN AND ROAD DUST MIXTURE IN SMALLER AREAS



METHOD OF DISTRIBUTING PARIS GREEN AND ROAD DUST MIXTURE ALONG THE COMPANY'S RAILWAYS



OIL DRIP DESIGNED FOR LARVICIDING MOSQUITO-BREEDING AREAS OF WATER WHICH
CANNOT BE ELIMINATED



NEW TYPE OF LATRINE UNDER CONSTRUCTION SHOWING THE CASING AND AUGER WITH WHICH THE HOLE WAS BORED TO A DEPTH OF 12 OR MORE FEET. THIS WILL BE FURNISHED WITH CONCRETE BASE

AND HOUSE. THIS TYPE OF LATRINE IS FREE FROM ODORS AND DOES NOT ATTRACT FLIES



AERIAL VIEW OF TRUXILLO RAILROAD COMPANY HOSPITAL, SCHOOLHOUSE, AND ADJOINING RESIDENCES
TAKEN FROM ONE OF THE COMPANY'S AIRPLANES



UNITED FRUIT COMPANY CLUB HOUSE FOR EMPLOYEES IN THE COLOMBIA DIVISION



DINING ROOM IN UNITED FRUIT COMPANY CLUB HOUSE FOR EMPLOYEES



A RECREATION ROOM IN UNITED FRUIT COMPANY CLUB HOUSE FOR EMPLOYEES



SOCCER GAME IN PROGRESS ON UNITED FRUIT COMPANY ATHLETIC FIELD IN THE BANES DIVISION (CUBA)



POLO TEAM OF THE UNITED FRUIT COMPANY BANES DIVISION (CUBA)



GROUP OF EMPLOYEES AT THE GOLF GROUNDS OF THE UNITED FRUIT COMPANY, PANAMA DIVISION



RECREATION GROUNDS IN A FARM DISTRICT OF THE COLOMBIA DIVISION

SECTION III

BERIBERI

WALTHER JANTZEN, M.D.

Truxillo Railroad Company Hospital

Puerto Castilla, Honduras

Preliminary Remarks.—In the Sixteenth Annual Report of the Medical Department of the United Fruit Company (1927) I reported five cases of beriberi-like polyneuritis in our Division, which were observed during the years 1925–1927, and which showed the symptoms typical of the paraplegic form of beriberi. Similar cases had never before been seen nor reported in Honduras, so far as I could ascertain. There are several reasons that prevented me from identifying this disease with the paraplegic form of beriberi. The cases were few in comparison with the great number of patients we see every year in our Hospital. Also, there was no evident change in the living conditions of our laborers during recent years which could explain the sudden origin of such a disease; and, if the conditions had really changed to some extent, one should surely expect a further extension of the disease among our laborers, as all the people live under practically the same conditions. Furthermore, as the food consists in the main of beans and maize (both rich in Vitamin B), rice and some meat and, to some extent, bananas and plantains, one would think that there was a sufficient amount of Vitamin B to prevent beriberi. The food-deficiency factor does not offer a very satisfactory explanation as to the etiology of our cases. Also, if an infection were the underlying cause, the cases seemed to be comparatively rare and independent from one another. At that time, therefore, I left the question “beriberi or polyneuritis” undecided.

Increase in Cases During 1928.—During the year we have had a remarkable increase in the number of similar cases. Instead of 5 cases in 3 years, we have had this year 18 cases with typical symptoms, and a few others in which the diagnosis could not be made with certainty, on account of doubtful symptoms. Although this number is a small percentage of the patients treated in the Hospital for other conditions, the increase over the 3 preceding years is of considerable interest from a medical and also from an economic standpoint, for it will mean an even greater loss of labor days if the disease continues to increase in this ratio.

Three Typical Cases Summarized.—Reports of 3 cases are submitted to illustrate typical symptoms in varying degrees of severity:

CASE 1

M. A., Honduran male, aged 31 years, was admitted to the Hospital on October 26, 1928, with a history of 2 months' illness during which he complained of numbness and weakness of the legs. A few days before admission he also had had fever. Alcoholic drinks were used in moderation. He had never been seriously ill before. The food was of the usual native type, consisting in the main of beans and polished rice, little meat, and a few plantains.

Physical Examination.—He was well-developed and well-nourished. Dental caries was present only in moderate degree, and the tongue was coated. The organs of the chest and abdomen were normal, with the exception of a moderate enlargement of the spleen. The patellar and tendo-Achillis reflexes were absent; other reflexes were normal. There was a marked decrease of power in the muscles innervated by the sciatic nerve. The tactile sense over the skin on the inner side of the leg and on the dorsa of the feet was diminished. There was slight pain in the muscles of the calves, on pressure. The blood film showed some parasites of tertian malaria, and the stool a few ova of *uncinaria*. The temperature was continuously normal or subnormal.

Developments.—He was discharged after 14 days' treatment with quinine, plasmochin, strychnine and food rich in Vitamin B. His condition was much improved.

CASE 2

C. S., Mexican male, (living the last 10 years in Honduras) motor boy, aged 27 years, was admitted to the Hospital on October 10, 1928. He had been discharged from the Hospital only 3 weeks before, when he had suffered from a slight infection of *E. A. malaria* (10 days' treatment in the Hospital). The patient was intelligent. He stated that he felt weak and had had swelling in the face and legs for about 1 week before admission. For the past 4 days he had had great difficulty in walking. He also felt a numbness of the lips. During the past 2 years he had used alcoholic beverages about once or twice a month, and on those occasions had been intoxicated. In 1921 he had had a chancroid with bubo; later he suffered for 1 year from insomnia and nervousness. His food had been approximately the same as that of Case 1.

Physical Examination.—He was fairly well nourished and developed but somewhat anaemic. Slight oedema of the face and legs was present. The spleen was enlarged 1 finger below the costal margin. Other organs of the abdomen and of the chest appeared normal. The blood was negative for malaria and syphilis, and the urine was negative. The stool contained ova of *uncinaria*. The examination of the nervous system revealed a slight paralysis of the inferior part of the 7th cranial nerve. The patient could neither whistle nor spit; there was also difficulty in masticating. The cornea and throat reflexes were absent. Other cranial nerves appeared to be normal. All reflexes of the arms were

present, as were also the abdominal and the cremasteric reflexes. The knee jerks were exaggerated; tendo-Achillis and Babinski reflexes were absent on both sides. There was marked weakness in the legs. The flexor muscles of the thighs were partially paralyzed. All muscles of the legs were painful on pressure. There was loss of the tactile sense over the skin on the inner side of the calves of both legs and of the dorsa of the feet; and a decrease of the pain sense to pin-pricks over the same area. The bladder and other sphincters were normal. The patient ran a normal or slightly subnormal temperature during his stay in the Hospital.

Developments.—The nervous conditions improved slowly. On his discharge, December 12, 1928, after 72 days' treatment, there was still weakness in the legs and some atrophy of the muscles. The sensibility was normal. The reflexes were unchanged. The treatment consisted of strychnine, arsenic, massage, and food rich in Vitamin B.

CASE 3

E. R., Honduran male, aged 20 years, was sick in camp with fever and cold, and complained of having had pains in the legs and body for 10 days. He entered the Hospital on August 11, 1928.

Physical Examination.—The patient was poorly developed and poorly nourished. There were a few ulcerations on both legs. The muscles of the legs were tender on pressure. The head and the organs of the chest were normal. The spleen was enlarged, its margin palpable one finger below the costal margin. The knee jerks and tendo-Achillis reflexes were present and equal. The blood was negative for malaria and also for syphilis. The urine was negative. The stool revealed ova of uncinaria. The food in the camp was of the usual type.

Case History.—The patient ran an irregular temperature up to 103° for 6 days after admission to the Hospital; then the temperature dropped to normal and remained so up to the time of discharge. No cause of the fever could be found. On August 16, 1928, 5 days after admission, the patient first claimed that he had difficulty in walking, his gait being somewhat ataxic. The examination of the nervous system 2 days later revealed a marked loss of strength in the arms. The arm reflexes were normal. The patellar and tendo-Achillis reflexes were absent. The cremasteric and the superior and middle portion of the abdominal reflexes were present; reflexes of the inferior portion and the plantar reflexes were doubtful. There was a complete paralysis of both peroneal nerves and an almost complete paralysis of the other muscles innervated by the sciatic nerves. The muscles innervated by the femoral nerve were almost completely paralyzed. There was no tactile nor pain sense over the skin of the inner side of the calves of both legs. Subjectively there was numbness in the feet and the finger tips. The cranial nerves were normal.

Developments.—The treatment consisted of strychnine, iron, arsenic and qui-

nine. The diet was the same as that given to the other patients. In about 6 weeks the patient began to walk, at first on crutches. In November the muscles innervated by the peroneal nerves began to be active. There was marked atrophy of all the muscles of the legs. The examination of the reflexes revealed no change in the condition present on admission. The general condition was excellent. After 109 days' treatment he was discharged (12-2-28). He works as an orderly in the Hospital, and I had therefore a chance to reexamine him recently. This examination (1-20-29) revealed a good general condition. With the exception of the tendo-Achillis, all other reflexes were normal. The muscles of the calves were still somewhat painful on pressure, and there was still a small area of skin near the inner side of the right ankle which showed a slight disturbance of the tactile sense. The muscles of the legs were still somewhat atrophic and the strength subnormal. Since discharge he has constantly taken a properly balanced diet.

Remarks on Three Cases.—Only one of these three cases showed slight oedema of face and legs. A case whose symptoms corresponded closely to the typical oedematous type of beriberi came to my attention only once, and the history is submitted below:

CASE 4

V. H., Honduran male, aged 25 years, was admitted to the Hospital on May 12, 1928. The patient stated that he had been sick in the camp for about 8 days on account of a general swelling of the body. He had taken Epsom salts and some quinine in the camp.

Physical Examination.—He was a well-developed and well-nourished native. There was marked oedema of the face and legs and slight ascites. The glands of the groins were enlarged. The examination of the chest revealed some sibilant râles and a slight dullness over the right base from the 7th thoracic vertebra downward, accompanied by decreased respiratory sounds, suggesting a slight transudate. The right heart was slightly dilated. Blood pressure, systolic 90, diastolic 60. The nervous system was normal. The blood examination revealed E. A. malaria parasites. The stool contained ova of uncinaria, the urine a trace of albumin and a few pus cells; haemoglobin 90%.

Developments.—The patient had no fever. The oedema disappeared within 3 days under liquid diet and quinine treatment. He was discharged 6 days after his admission, without any symptoms.

GENERAL DISCUSSION OF CASES

We had 8 cases of different degrees of severity, which corresponded to Case 1. Their symptoms were therefore only slight. The deep reflexes of the legs were absent—wholly or in part; the sensibility was disturbed in different degree, but there were no paralyses. Six cases corresponded to Case 2. In these there

were found paralyses of greater or lesser degree, but the ability to walk was never lost. The other 4 cases corresponding to the type of Case 3 were for some time unable to walk. Oedemas in connection with disturbances in the nervous system were found only twice; oedema without these disturbances and without any explainable cause, were found only once (Case 4). There were a few more cases with slight nervous disturbances, but their symptoms were not characteristic and were so slight that they are not included in this report.

All cases were Latin-Americans who had lived a long time in Honduras. The average age was 37 years; the youngest patient was 20 years old, the oldest 55 years. Their average age was higher than that of our patients in general; and they had been employed by our Company for periods ranging from 6 months to 10 years. They were mostly laborers; 2 were foremen and 1 a motor boy, a fact apparently indicating that better social conditions did not prevent the affection. Three patients lived on Copete Farm and 6 on Sico Farm; the others were scattered among various farms with no local connection. The seasonal incidence is remarkable. All cases were seen during the wet season from August to February, the months of October, November and December showing the greatest number of cases. The same condition held true in previous years. Thirteen of our cases had ova of *uncinaria* in the stools. Three showed malaria parasites in the blood, 5 claimed to have had fever in camp before admission, and only 1 had fever in the Hospital, the cause of which could not be found. His nervous symptoms developed after his admission to the Hospital and during the fever stage. Another one developed the symptoms after an operation for haemorrhoids. The general physical condition on admission was noted as fair in 5 cases, poor in 2 cases, good or very good in 8 cases; in 3 the condition was not noted. Enlargement of the spleen was found several times. The test for syphilis was negative in all the cases; the spinal puncture, when done, revealed a normal fluid. Alcoholism to some extent was admitted only twice. Never did the examination suggest evidence of chronic alcoholism. The food was in the main the same in all cases. Beans and polished rice and meat were the principal elements of their meals. Some ate more cereals (cornflakes, oatmeal, white bread, tortillas of white flour), others laid stress on the fact that they ate native maize, eggs, much milk, plantains, bananas and green vegetables. In the Hospital we gave for treatment in addition to strychnine, arsenic and quinine (when indicated) a special diet consisting of brown bread, green vegetables, fruits, including bananas, beans and meat. Recently I have given yeast. Massage and active movements of the limbs were practiced. The time under treatment varied with the severity of symptoms and with the perseverance of the patients. Some left the Hospital before they were cured. Light cases were often discharged early and given instructions in regard to diet. One patient remained in the Hospital for 109 days and others only 8 days. The average length of time under hospital treatment was 36 days, and no deaths occurred.

CONCLUDING COMMENTS

The question is—in view of the observations made this year—Can we state definitely that we are dealing with beriberi? The clinical symptoms were of the paraplegic form, and some cases had oedema also. Other causes which could have produced similar symptoms are arsenic, lead or food poisoning, nephritis, and cardiac failure; and these were easily excluded. Our patients did not show any symptoms of chronic alcoholism nor of having had severe malaria or syphilis. The low temperature found in most of our cases and the fact that they occurred during the cool, wet months of the year are evidences which conform with the diagnosis of beriberi. The objections to this diagnosis discussed last year and mentioned briefly in the beginning of this report, are still sound. Fever was observed in the beginning of the disease in some of our cases, and could not be explained by any of the usual causes; it points at least to some complicating condition if food deficiency is the cause of the disease. The rare occurrence of the oedematous form is to be noted. This does not conform with the usual experience with beriberi occurring in other countries. Case 4 is mentioned above among the doubtful cases because the hydrops disappeared within 3 days under liquid diet very poor in vitamins. As referred to in last year's report, the food-deficiency theory does not completely classify the etiology, inasmuch as our laborers eat at least a small amount of food containing Vitamin B. It is questionable whether the possible increased use of polished rice and of refined cereals by our laborers in recent years can account for Vitamin B deficiency to the extent of causing isolated cases of beriberi and yet not cause a greater incidence of the disease throughout the Division.

Considering the facts mentioned above, it is difficult to come to a definite decision in regard to the diagnosis and have it conform with the existing theory of its etiology. In other countries (Brazil) beriberi cases do not show exactly the same characteristic features as those reported from Asiatic countries, and consequently we are justified, I believe, in classifying our cases as beriberi also.

CHARCOAL IN THE TREATMENT OF BACILLARY DYSENTERY

E. J. WHITAKER, M.D.

Tela Railroad Company Hospital

Tela, Honduras

In the spring and summer months of 1928 we treated in Tela Hospital 68 cases which were clinically diagnosed as bacillary dysentery, with a mortality of about $7\frac{1}{2}\%$. In 50 of the cases whose stools were cultured 17 were positive. The bacillus isolated in the majority of the cases was of the Shiga type.

Clinically most of these patients were more toxic and more acutely ill than is generally observed to be the case in amoebic dysentery. A complicating arthritis was not an uncommon occurrence.

The majority of the cases were male laborers, and the treatment in the wards of the hospital consisted in giving a liquid, bland, nutritious diet; rest in bed; and hot applications to the abdomen. In those cases where not enough fluids could be taken by mouth, or where collapse threatened, a subcutaneous normal salt solution was administered. In the acute cases enemas were not found to be helpful. Cpiates were given when there were severe tenesmus and cramping pain.

Sodium sulphate, a teaspoonful in warm water, was given every morning. Bismuth subnitrate and calcium carbonate, in $\frac{1}{2}$ teaspoonful doses of each, were given every 4 hours. Later, powdered charcoal ($\frac{1}{2}$ teaspoonful) was added to this mixture, and following this addition it was believed that an improvement in the condition of the patients was observed. They were less toxic, although the number of stools was not materially diminished.

CONCLUSIONS

Several times during the months when these cases were undergoing treatment, our supply of charcoal gave out. Thus we had an opportunity of observing how our patients fared both with and without charcoal. We are under the impression that its administration brought about a distinct improvement in the condition of the patients, and materially aided in hastening the convalescence.

THE TREATMENT OF LOBAR PNEUMONIA WITH INTRAPULMONARY INJECTIONS OF PATIENT'S WHOLE BLOOD

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United Fruit Company Hospital

Quirigua, Guatemala

PRINCIPLES OF THE NEW METHOD

During the period from July, 1928, to February, 1929, all known cases of lobar pneumonia under the writer's care have been subjected to a new principle and practice of treatment. This treatment has consisted of daily or more frequent injections of patient's whole blood into the site of pulmonary consolidation. To date only 27 cases have been so treated, a number too small to form a basis for definite conclusions, but nevertheless sufficient to furnish a groundwork for more extended investigations.

It may be said that this radical method of treatment has not proved injurious;

indeed, there is evidence to indicate that it may have been instrumental in lowering mortality. The principles upon which this treatment is based, are the following:

1. In lobar pneumonia the circulating blood supply of the consolidated area is diminished, its vital resistance thereby lowered, and its defense against pneumococcic invasion and multiplication lessened.

2. The full antibody volume of blood is not delivered to the affected lobe.

3. Dilatation of the right side of the heart, commonly occurring in pneumonia, is accepted as evidence of added cardiac effort to meet heightened intrapulmonary arterial tension. Withdrawal of venous blood and its injection into the lung may be thought to alleviate this circulatory unbalance, since the blood is placed in the periphery of the lung, where it can not materially increase the blood pressure in the hilus.

4. It has been demonstrated that an increase in hydrogen ion content is established in pneumonic tissue. Partial correction of acidosis should be effected by the introduction of blood withdrawn from the systemic circulation.

5. The mechanical action of blood injected under pressure may loosen fibrinous intra-acinus exudate and stimulate leukocytic reaction.

TECHNIQUE

The skin over the antecubital fossa corresponding to the affected side is prepared with tr. iodine and alcohol. A tourniquet is adjusted above the elbow, and 20 cc. of venous blood are withdrawn into a Luer syringe. A small piece of gauze is placed at the puncture site, the elbow flexed, and the patient turned on his opposite side by an assistant. The skin overlying the area to be injected is wiped briskly with an iodine and alcohol sponge. The needle (of the usual intravenous type—not exceeding 5 cm. in length) is introduced its full length—with syringe attached—through an intercostal space. Expedition may be secured by using the palpating thumb as a guide to the intercostal space. With the shoulder of the needle held firmly against the skin, injection is carried out with ordinary pressure on the piston. If coughing or deep inspiration causes movement of the needle, the injection is momentarily halted and the syringe held lightly to facilitate its counter-movement with the needle point. This insures avoiding laceration of pulmonary tissue.

In approximately 80% of the injections haemoptysis occurs. This takes place, in most instances, toward the end or after the conclusion of the injection. Should it occur early, the injection need not be discontinued unless coughing is paroxysmal and distressing (in 2 of 105 injections). Pain is seldom marked. Coughing may be absent, or may be present and last for 30 minutes or longer. This feature is, of course, most noticeable in pleural involvement and when narcotics have not been employed.

It is very important to carry out the entire technique with a moderate degree of speed to avoid coagulation of blood. Should unusual effort be required to

make the injection, it should at once be discontinued. A fresh needle and syringe may be secured and employed.

ROUTINE INJECTION TREATMENT

In cases of ordinary severity, one injection a day has been employed. In obviously grave cases, two or more have been given. Logically, it would seem that injections at intervals of several hours might prove useful. This consideration, of course, must depend upon other aspects,—such as the degree of dyspnoea and distress caused by turning the patient; severe cardiac embarrassment; and the course of the disease.

An effort has been made to diversify the site of injection, in order that different areas of consolidated tissue may be subjected to therapeusis. In lower-lobe involvement, the initial injection is usually made beneath the tip of the scapular angle, succeeding injections in the paravertebral line above and below this level, in the scapular line (9th and 10th spaces), and in the posterior and middle-axillary lines. In upper-lobe involvement injections are made posteriorly, anteriorly in the mid-clavicular line (2nd and 3rd spaces on the right side), in the apex of the axilla, and in the anterior-axillary line. If the procedure is well borne in multilobar involvement, two injections may be made at the same time.

With the exception of cough reflex, no definite reaction has been observed to follow whole-blood injection. There have been no instances of collapse, syncope, pulmonary oedema or haemorrhage from the lung. The needle employed penetrates the periphery of the viscus from 1 to 4 cm., according to the thickness of the chest wall, pleural thickening, or effusion. Injection has been made through effusion in 1 case without incident. Only 1 patient in the series developed empyema. This was of the interlobar type, definitely localized; it was diagnosed by Dr. R. C. Connor and successfully operated upon. No other complications attributable to the procedure have thus far been witnessed. In 5 cases brought to autopsy, all of which had had injections within intervals varying from 6 to 10 hours before death, only 1 showed evidence that injection had been made. In this instance an elliptical blood clot 5 x 1 cm. was revealed at the injection site. This finding was due to delay in completing the injection technique.

SUPPLEMENTARY TREATMENT

The principals of supportive treatment have emphasized rapid and complete digitalization, administration of fluids by hypodermoclysis in toxic and dehydrated cases, special attention to nutrition, avoidance of drastic catharsis, the use of bed pans, and the exhibition of narcotics to insure comparative freedom from pain. For control purposes, the use of mercurochrome was confined to 4 cases, 2 of which succumbed. It is the writer's opinion that mercurochrome is of value in certain cases if administered early in the course of the disease.

The experience of Phelps¹ has supported the usefulness of mercurochrome in the treatment of pneumonia.

ANALYSIS OF FATAL CASES

A brief summary of the salient features in the fatal cases is presented in the following table:

Case No.	No. of Days III Prior to Administration	Days in Hospital	No. of Blood Injections	Clinical and Autopsy Findings
1	7	2	5	3 lobes; ileus
2	8	2	3	Total arrhythmia; 1 lobe; ileus; peritonitis
3	6	5	7	2 lobes; hobnail liver
4	2	4	2	No autopsy; 1 lobe
5	9	2	1	No autopsy; cardiac dilatation; 1 lobe
6	3	11	13	Ileus; 4 lobes
7	4	27	4	Multiple abscesses of kidneys (pneumococcic). Complete resolution both lower lobes
8	Undeter- mined	20 hrs.	0	Cerebral malaria; 1 lobe

It will be seen that the length of time prior to hospital admission has been a factor of major importance in the determination of outcome; the average for this group is 5.6 days.

RESULTS OF TREATMENT

It can not be too strongly emphasized that a larger number of cases than the series here presented is necessary in order to evaluate the efficacy of any method of treatment. For this reason, no claim can properly be made in support of the procedure suggested above. A study of pneumonia mortality in the divisions of the United Fruit Company reveals wide variations from year to year—a circumstance which may lead to the belief that mortality closely corresponds to the type of pneumococcus predominating in a community during a given interval of time.

The all-division mortality rate of the United Fruit Company, from 1914 to 1922, was 45.9%. From 1922 to 1927 the rate was reduced to an average of 37.4%,—the percentage for the Guatemala Division during the latter period being 39.9. In the present series, 28 cases came under the writer's observation. Of these, 8 died—a general mortality of 28.5%. Of those who died, 1 patient had severe cerebral malaria and died within 24 hours of admission. He showed undiagnosed lobar pneumonia at autopsy. This case was untreated. A 2nd case received only a single blood-injection, while a 3rd, who had double lobar pneumonia, died 2 weeks after the crisis. Post-mortem examination revealed

complete pulmonary resolution with multiple pneumococcic abscesses of both kidneys.

For comparison, the most recent compilation of pneumonia statistics may be summarized, interpreting the effect of the administration of concentrated refined specific antibody serum (Felton's serum) under the most advantageous circumstances. Park *et al.*² analyzing all pneumonia cases admitted to the Bellevue, Harlem and New York Hospitals during 1927 and 1928, report a general mortality rate of 27.5% with serum treatment, and 33.2% without serum. Cecil and Sutliff,³ in a similar summary of recent cases in Bellevue Hospital alone (representing an economic and social type of patient more comparable to our own) report a mortality rate of 30.0% in treated cases and 39.2% in untreated cases.

SUMMARY

1. Intralobar injection of patient's whole blood has been practised in a limited series of cases of lobar pneumonia without untoward results, and possibly with benefit.

2. The possibility of obtaining gratifying results from intrapulmonary therapeusis, as mentioned immediately above, has prompted Dr. W. E. Deeks to suggest a similar use of such other agents as normal saline, alkaline solutions, and citrated blood. Mercurochrome and antipneumococcic serum employed in the same manner might also prove beneficial.

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LOBAR PNEUMONIA

B. M. PHELPS, M.D.

Truxillo Railroad Company Hospital

Puerto Castilla, Honduras

SUMMARY OF CONDITIONS

It is indeed encouraging to note the constant improvement in the diagnosis and treatment of most medical and surgical conditions which come to our attention, but unfortunately this statement does not include lobar pneumonia. That disease accounted for more than 25% of the deaths among our hospital patients during the year 1928.

Although a large majority of our cases in this section of the world fall within group IV,¹ there is still hope of a future specific serum treatment which will be of value.²

All cases for the year have been carefully reviewed in search of facts which might influence the mortality, and any data which might be of significance are incorporated in this article. These cases were on the services of 3 different physicians, and the methods of treatment were almost entirely symptomatic.

TABLE 1
COMPARISON WITH PREVIOUS YEARS

Year	Number of Cases	Number of Deaths	%
1921	31	8	25.80
1922	60	39	65.00
1923	97	52	53.61
1924	101	43	42.59
1925	100	30	30.00
1926	63	23	36.50
1927	55	21	38.18
1928	76	30	39.47

The average number of persons dependent on the Hospital for treatment was approximately the same in the years 1927 and 1928. One of the cases included in the 1928 series came from a neighboring town, the population of which is not included in our census. Nevertheless, there is an increase in morbidity compared with 1927, from 7.58 per 1,000 to 10.20 per 1,000, and an increase in the mortality rate of 1.29%.

There has been little difference in the rainfall (6.30 inches more in 1927) and the temperature as compared with last year. I have not been able to observe a constant relationship between the occurrence of pneumonia and the changes in seasons which, in this climate, mean only a slight variation in temperature but often a marked variation in the amount of rainfall.

TABLE 2
SHOWING SEASONAL INCIDENCE

	Jan.	Feb.	Mar.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
Cases	4	3	9	7	9	3	7	13	9	6	1	5	76
Deaths	3	2	6	1	2	1	4	6	1	3	0	1	30
Av. Rainfall	11.22	4.33	4.89	5.14	3.44	7.78	9.13	5.49	5.17	11.00	17.15	13.04	97.78
Mean Temp.	73	77	78.5	82	80	82	80.5	80	82	77	77	77.5	77.5

TABLE 3
SHOWING CASES BY NATIVITY

	Spanish Honduras	Salvador	Nicaragua	Costa Rica	Jamaica	British Honduras	Total
Cases	53	15	5	1	1	1	76
Deaths	21	5	2	1	0	1	30

As will be noted, no cases occurred among individuals coming from the temperate zone. Our laboring people seem particularly susceptible to pneumonia, and show a low resistance to infection. Among the probable reasons are unbalanced ration, frequent exposure to the elements over a considerable period, lack of personal care and hygiene, and the presence of chronic diseases such as hookworm, malaria and anaemia.

TABLE 4
SHOWING CASES BY SEX

	Male	Female	Total
Cases	62	14	76
Deaths	22	8	30
Per Cent	35.48	57.14	39.47

There is a particularly high mortality among female cases for the year. The average age of females dying from pneumonia was 36.7 years as compared with 28.7 years for males dying from the same disease.

COMMENTS

The case records, and not the patients, were examined by the writer.

Thirty localities in the Division were represented by pneumonia cases; the greatest number coming from Puerto Castilla (12 cases) where the largest number of individuals reside, but where the necessary exposure is least and where access to treatment is the easiest.

The average time sick in camp before hospitalization of the cases dying was about 8 days, while the time sick in camp for cases recovering, was 6 days. The average number of days spent in the Hospital by cases recovering was about 23 days. One case developed 10 days post-operative to a clean appendectomy. Twenty-six of the fatal cases came to post-mortem.³ In all cases the pneumonia had been properly diagnosed but in some cases an encapsulated empyema had

been overlooked, as well as other complications, most of which were not remediable. In most cases multiple lobes were affected. Exudative or purulent pericarditis was present in 6 cases. One case had a post-abortion uterus of a 4-months pregnancy, filled with about 200 cc. of a solution that appeared to be lysol. Among the other complications noted at autopsy were pulmonary tuberculosis, chronic pleurisy with adhesions, tuberculous peritonitis, chronic splenitis, acute dilatation of the heart, parenchymatous degeneration of the kidneys, myocarditis, acute nephritis, uncinariasis, tertiary syphilis, chancroids, pleural effusion, gall stones, puerperal sepsis, generalized lymphadenitis, bronchopneumonia, luetic aortitis, tertian malaria, passive congestion of the liver, ascariasis, E. A. malaria, and osteomyelitis of the ribs.

As noted above, the treatment of most of the cases was not directed to any specific method. Mercurochrome intravenously enjoyed little favor, and in most cases was reserved until it was apparent that all other lines of treatment had failed. The potassium permanganate treatment of Nott⁴ was used on several cases with indifferent success. Whisky as a supportive was given in a few cases. A large number of the drugs which are recommended generally were used in the treatment of the cases or their complications.

CONCLUSIONS

No reason is noted for changing my views on this subject as expressed in last year's Annual Report.⁵ Cases should come under medical observation sooner after the onset of symptoms. Treatment with calomel, salts and quinine in camp simply lowers the patient's resistance to the disease. In fact, the administration of large quantities of drugs in the treatment of lobar pneumonia is only to be condemned. Carbon tetrachloride should never be administered until the patient is well on the road to recovery. Morphine and whisky, judiciously prescribed, tend to keep the patient comfortable. Intravenous mercurochrome, if used, must be administered early in the course of the disease and in sufficient doses to obtain the required reaction. Early hospitalization and early diagnosis are absolutely essential in the successful treatment of these cases.

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BRONCHIAL ASTHMA—CASE REPORT

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Symptom-complex Described.—Bronchial asthma is a symptom-complex, occasioned by a variety of factors, which vary in character and in their reactions on different individuals. The symptoms arise from recurring reflex spasms of the muscles of the bronchioles, which narrow the caliber of the lumen and thus interfere with the ingress and egress of air, resulting in dyspnoea—at times prolonged and distressing in character. The tendency among physicians is to attribute this condition to the anaphylactic action of some protein of animal or vegetable origin.

Importance of Correcting Improper Diet.—The writer believes that in many cases of asthma the symptomatology can be attributed not to proteins, but to entirely different etiological factors that are directly concerned with an unbalanced food-intake deficient in essential factors. For many years the writer has been following a method of treatment which rests solely on the correction of improper diets, and making them complete in all essential factors. In almost all cases of asthma observed by the writer, where the cooperation of the patient was obtained this method of treatment has given gratifying results.

Fundamental Food-stuff Groups.—Of the different fundamental groups of food-stuffs—proteins, fats and carbohydrates—the last group only needs extensive consideration. The normal amount of proteins considered necessary to meet daily requirements is about 100 grams, or about $3\frac{1}{2}$ ounces; and of this amount about 30%, according to Callow, should be derived from animal sources (flesh foods, liver, kidneys, cheese, fish and shellfish), and the rest should be obtained from vegetable sources—chiefly cereals, legumes and nuts. No variation from these amounts is recommended.

Fats, to the extent of $2\frac{1}{2}$ to $3\frac{1}{2}$ ounces daily, are allowed in the forms of butter, animal fats and vegetable oils.

The carbohydrate foods may be grouped as follows: (1) cereals; (2) sugars; (3) tuber and root vegetables; (4) legumes (peas, beans and lentils, green or dry); (5) leafy green vegetables; (6) products of vines (melons, squash, cucumbers, pumpkins, etc.), including tomatoes; and (7) fruits.

Cause of Poorly Balanced Diets.—Unbalanced diets are usually the result of the excessive consumption of food-stuffs included in the first two subdivisions of the carbohydrate group, as they are generally refined before they are consumed, while the vegetables and fruits in the other five groups are not, and can be consumed with perfect impunity. In the cereal group of foods, which include wheat, rice, corn, barley, oats, etc., and their derivatives—including breakfast cereals—the husks, the vitamins, and an important part of the mineral salts are removed in the refining or milling processes. Moreover, they, like animal flesh foods, have an acid ash, though to a lesser degree. When cereal-derived foods enter too largely into the diets, there is generally an insufficient intake of Groups 3 to 7 inclusive; and consequently there is a deficiency of vitamins and of alkaline inorganic salts necessary for health requirements.

Sucrose, which is generally used for sweetening foods and drinks, is a pure carbohydrate and the most fermentable form of it that we know. With many individuals it is prone to fermentation in the alimentary tract, causing indigestion, diarrhoea, etc. Moreover, the products produced by fermentation are diffusible and are absorbed into the circulation, with the result that a great many systemic disturbances arise, which predispose to organic diseases.

Striking a Balance in Diet.—In the treatment of cases of bronchial asthma and many other systemic disturbances and diseases, all artificially-sweetened foods and drinks are prohibited, and the intake of cereal-derived foods of all kinds is restricted to from 2 to 6 ounces daily, the amount permitted depending upon the energy requirements of the individual. These include breads, cakes, pastries, vermicelli, spaghetti, degerminated cornmeal, polished rice, hominy, etc., and breakfast cereals of all kinds. The restriction of the cereal-derived carbohydrates necessitates for energy requirements an increase in the intake of starchy foods from other sources, such as legumes, tubers, fleshy roots (carrots, turnips, beets, onions, parsnips, etc.), and particularly of leafy green vegetables and fresh fruits (not canned) of all kinds, including the fruits of the vine (melons, squash, pumpkins, tomatoes, etc.).

After this manner, the full requirements of a properly-balanced diet will be met in all factors—namely, proteins, fats, carbohydrates, vitamins and inorganic salts—acid and alkaline. It should be remembered that Vitamin C is more or less destroyed by oxidation in the processes of cooking, and in consequence some fruits and some leafy green vegetables should be consumed daily in a raw condition, in order that the diet may include the Vitamin C element in a sufficient amount.

The following report on a case of bronchial asthma illustrates the result from this method of treatment:

CASE REPORT

History.—G. F., white, American, sanitary inspector, aged 67 years, 5' 9" in height, had suffered from recurrent bronchial asthma since 1917. The at-

tacks occurred about twice a month or oftener. In 1918, owing to their severity, he was treated at two different times in Ancon and Colon Hospitals, in Panama, remaining for a week in each. In 1919 he went to Cuba, hoping that the change of climate would improve his condition, but his attacks continued to recur, and on many occasions he was compelled to resort to the use of injections of morphine and adrenalin, frequently obtaining only partial relief. He was treated in Preston by Dr. de la Guardia in 1923, when he suffered from a typical attack. At that time his systolic blood pressure was 220, and he was advised of the danger of using adrenalin, which he was in the habit of taking, himself, in order to obtain relief. His diet was investigated from the standpoint of finding some protein that might cause the anaphylactic reaction, but the results were negative, and refined carbohydrate foods were not then considered to be an etiological factor. His attacks became progressively worse until June, 1928, when he consulted the writer in New York.

Examination and Treatment.—At that time he was suffering from a severe attack. His blood pressure was about the same as that recorded by Dr. de la Guardia, and his weight 210 pounds. The urine examinations were negative, and he stated that his Wassermann had also been negative upon repeated examination. Careful investigation of his diet revealed the fact that he was in the habit of eating excessive amounts of carbohydrates, particularly rice, and also sweets. He used an average amount of flesh foods, but there was a lack, or low intake, of green vegetables and fresh fruits. He was then advised to follow the diet outlined above, and to discontinue injections of adrenalin and morphine.

Results.—Within 48 hours his attack was relieved without any sort of drug administration. In about 6 weeks he returned to Cuba. Early in January, 1929, the writer saw the patient in Preston. He then weighed 194 pounds, his blood pressure was systolic 155, diastolic 100, and he advised me that he had had no further attacks of asthma. A report, dated February, 27, 1929, states that the patient remains perfectly well, and is physically very active in his work.

CONCLUSIONS

This "standard" method of dieting is recommended for the prevention and treatment of a great many morbid conditions, including not only the vitamin-deficiency diseases (pellagra, sprue, rickets and scurvy), but also all systemic disturbances and organic degenerations not directly attributable to specific organisms.

CASE REPORT OF RUPTURED AORTIC ANEURYSM

WENDELL S. DOVE, M.D.

United Fruit Company Hospital

Almirante, Panama

Case No. 23,089. A Jamaican, aged 39, was brought to the Hospital by ambulance; he was sitting upright with no back support when he arrived.

Past History.—There was no history of previous illnesses except that of an almost constant pain in the epigastrium and over the sternum and back of chest for the past 7 months. A Meinicke serological examination performed 11 months ago was positive with "three plus" reaction. He did not return to the clinic for treatment.

Present Illness.—At midnight of the day before admission he vomited a large amount of blood, after nausea which had lasted for about 10 minutes. After this he felt much relieved and rested fairly well until 5 A.M., at which time he again vomited a large amount of blood. He then felt very weak; a few hours later the ambulance was called, and he arrived at the Hospital at 12 noon in an extremely weakened condition, although able to furnish the history which has just been given.

Physical Examination.—The pulse was barely perceptible and the heart rate obtained by stethoscope was 120. The stomach was dilated and the heart apex pushed up to the 4th intercostal space. A stomach tube was passed, but no gas escaped. Water used as lavage returned deeply colored with blood. Shortly after gastric lavage, the patient vomited another large amount of blood. The abdomen was slightly distended and he complained of pain on pressure over the epigastrium. The heart sounds were only faintly heard.

Laboratory Findings: Haemoglobin 40%, leukocytes 20,000.

Treatment:

1. Gastric lavage
2. Hypodermoclysis
3. Intravenous normal saline solution
4. Adrenalin-chloride solution by hypodermic injection

It was at first considered that he was suffering more from shock than from haemorrhage, and in view of the epigastric pain and tenderness accompanied by leukocytosis of 20,000 and haemoglobin of 40%, I was of the opinion that we were dealing with a stomach condition, probably a perforated gastric ulcer with severe haemorrhage. The pulse grew progressively weaker and showed no response to intravenous administration of normal saline solution and adrenalin, and the patient died at 3.30 P.M., 15 1/2 hours after he had first vomited blood.

Autopsy.—An aneurysm involving the arch and descending aorta was found to have eroded into the oesophagus. The opening between the oesophagus and the aneurysmal sac measured 1.5 by 1 inch, and the margins were white and glis-

tening. The aneurysmal sac adjacent to the oesophagus contained a large lamellated clot which was partly organized and attached around the circumference of the perforation between the aorta and the oesophagus, except at one point where it was torn away.

This case is reported because it presented two interesting features:

First: The opening between the aorta and the oesophagus had apparently been present for a considerable length of time. A section taken through the margin of the perforation showed microscopically a dense fibrosis, and it therefore could not have been a recent rupture of the aorta. The blood volume under systolic pressure had evidently been held back by the adhesions of the clot to the wall of the aneurysmal sac, so that the patient was able to continue his work as a farm laborer until the day prior to his death.

Second: The patient lived 15 1/2 hours following his first haemorrhage from the perforation.

CARATE (PINTA) AS OBSERVED IN COLOMBIA, SOUTH AMERICA*

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The name pinta (from the Spanish word "pintar," meaning to paint) is used by American authors to designate a group of related or possibly identical diseases seen in various parts of tropical America. The disease appears to have existed among the Aztecs, though some investigators have claimed that it was imported to the new world by African slaves. It is found chiefly in certain parts of Mexico, Central America and some of the South American countries including Venezuela, Peru, Bolivia, Brazil and notably Colombia. Isolated cases are reported from Egypt, Tripoli, The Gold Coast, etc. The disease has many synonyms such as pinta, mal de pinta or tina in Mexico, cute or carare in Venezuela, cativi in Honduras and carate in Colombia.

The disease known as carate is prevalent in certain parts of Colombia; Montoya y Flores¹ estimated that there were 200,000 cases in that republic in 1898. Three years ago, Peña Chavarria and Shipley² considered the number of cases to be about 400,000, stating that the majority were found in the neighborhood of the large rivers. According to Urueta,³ the disease "in its purest form" is

* Read at the Fifty-First Annual Meeting of the American Dermatological Association, Washington, D. C., April 30, May 1-2, 1928.

1. Montoya y Flores, J. B.: *Recherches sur les Caratés de Colombie*, These de Paris, 1898.

2. Peña Chavarria, A., and Shipley, G. G.: *Contribución al estudio de los Carates de America Tropical* *Rév. Med.* 10: 648 (March) 1925; abstr., *Arch. f. Schiffs- u. Tropen-Hyg.* 29: 605 (Oct.) 1925.

3. Urueta, E.: *Pinta or Carate (With Special Reference to Treatment)*, *Proc. Internat. Confer. Health Problems, Trop. America*, 1924, p. 524.

gradually disappearing on the Atlantic Coast of Colombia, though there are still many cases to be seen in Santa Marta, where my observations were made.

A general description of carate as given by various authorities is somewhat as follows: The disease is endemic in certain hot, damp and low lying portions of tropical America. It is not hereditary, nor, according to Sandwith,⁴ directly contagious. It appears most often between the ages of 15 and 25, is less frequent in children and is rare or unknown in infants. It affects chiefly the dark races, and is extremely rare in the white race. It is essentially a local disease of the skin and does not produce constitutional disturbances. It begins on the uncovered parts of the body, including the hands, feet and face, and not infrequently becomes generalized. Its onset is insidious and its course extremely chronic. The characteristic features are pigmentary changes, the lesions in different cases assuming a blue, violet, red, black, yellow or white color, or at times a mixture of two or more. The terminal stage in many cases appears to be a complete depigmentation, though, according to some authors, the patches may be white from the outset. The palms, soles, hair and nails are not affected. In extremely chronic cases, the mucous membranes are involved. Scaling of the pityriasic type is present in the early stages followed by scaling of the lamellar type. Itching is said to be a prominent symptom. The patches are apt to be fairly well defined and asymmetrical in distribution.

PERSONAL OBSERVATIONS

My observations on carate were made in the hospital and on the banana plantations of the United Fruit Company in Santa Marta, Colombia, where I remained as a guest for a week. Every possible convenience was put at my disposal including a well equipped laboratory, photographic dark room, etc. A trip of 50 miles was also made to some of the rural dispensaries where patients with carate were assembled and some of them brought to the hospital for further study. The equipment that I took consisted of 100 culture tubes of Sabouraud's medium and a 5 by 7 camera with a 10 inch focal distance lens. In studying carate, I was left largely to my own resources, as there was no one in the hospital at the time who had made a special study or had an expert knowledge of the disease.

Examination of the patients with carate revealed a type of disease of the skin which I had never seen in the United States. Two years before, in Mexico City, I had seen two extensive cases of blue pinta which were somewhat different from any of the cases of carate in Santa Marta. At first glance, the most striking feature of carate was the complete depigmentation suggesting ordinary vitiligo which many of the patients presented about the wrists and ankles. Closer observation showed that while individual patches were identical with vitiligo, their constant association with pigmented or partially depigmented

4 Sandwith, F. M.: Pinta, Brit. M. J. 11: 1270 (Nov. 11) 1905.

areas did not leave any doubt that they were not this disease. As a matter of fact there were several patients with dark skin who were suffering from vitiligo which aided in a comparative study of the two conditions. The various changes of color described by different authors were not as striking as I had been led to expect. Patients with either yellow or red carate were not seen, the latter variety being extremely rare and said to occur only in the white race. With the exception of the white (vitiligid) patches, the only striking abnormality in pigmentation was a bluish color; which, however, was unlike any dermatologic condition with which I am familiar.

Twenty of the cases in which notes were taken showed some shade of slaty-blue, at times suggesting the color of powder grains in the skin and at times being dark enough to be called bluish black. There were not any cases which, as it seemed to me, could have been called black carate as there was always an associated bluish tint. Whether some of these cases with a bluish tint would have

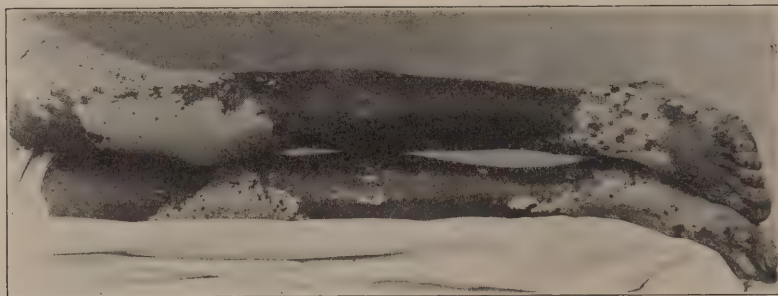


FIG. 1 (CASE 1). ENTIRE LOWER EXTREMITIES SHOWING PIEBALD APPEARANCE FROM CONTRAST OF COMPLETE DEPIGMENTATION WITH NORMAL OR DEEPLY PIGMENTED BLUISH SKIN

been classed as violet carate by experienced observers of this disease, I do not know. The bluish color was most frequently seen on the face, especially the malar region, nose, chin, lower part of the forehead and ears. It was also present on other parts of the body. The great majority of the bluish areas were entirely smooth and did not show evidence of scratching.

One of the prominent features of carate was a varying degree of depigmentation which was observed on closer inspection. A feature especially striking to a dermatologist was a peculiar, fine, reticulated, mottled or variegated appearance of some of the lesions. This was suggested in a published letter by Wise⁵ in recording a brief visit to Santa Marta. These reticulated areas were partly due to partial depigmentation and partly to bluish or brownish hyperpigmentation. In addition to this fine reticulation, there was the usual mottled or piebald appearance formed by the contrast of vitiligid patches and normal dark skin.

5. Wise, F.: J. Cutan. Dis. 32: 857 (Dec.) 1914.

While I saw fifty patients who were said to be suffering from carate, I was only able to obtain records of some value from twenty-five. Of these, there were twenty who presented some definite bluish pigmentation in addition to other changes in the skin. Of the latter, fifteen were males and five were females. The age varied from 9 to 60, the average being 33 years. All were more or less dark in color, four being apparently full-blooded negroes, the others a mixture of negro, Indian and white blood.

The duration of the disease in seventeen cases, in which this was known, varied from seven to fifty years, the average being fourteen years. If the two cases of extremely long duration are omitted, the average duration was lowered to eleven years.

The eruption involved the extremities in every case, both upper and lower being affected, except in two cases. In thirteen cases the eruption appeared on the face and neck as well as on the extremities and the trunk. The forearms and legs, particularly the extensor surfaces, were more often affected than the arms and thighs. In some cases the eruption was generalized and profuse. The

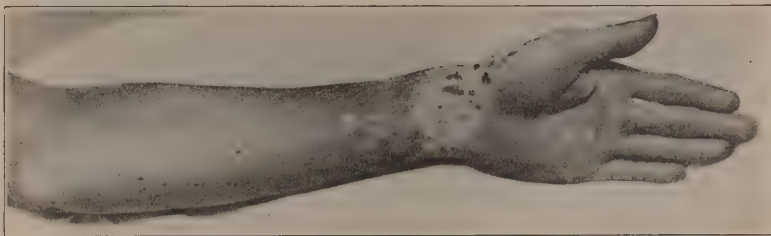


FIG. 2. THE ENTIRE FOREARM IS AFFECTED; THE GREATER EXTENT OF FLEXOR SURFACE RETICULATION IS DUE TO VARYING DEGREES OF DEPIGMENTATION AND PUNCTA OF NORMAL OR BLUISH SKIN; AREAS OF COMPLETE DEPIGMENTATION ARE SEEN ON THE FRONT OF THE WRISTS

front of the wrists, knuckles, back of fingers and malleoli were favorite sites for vitiliginous patches. Some of the areas affected are shown in figures 2, 3, 4, 5 and 6.

The type of eruption varied greatly and formed an unusually variegated picture in some cases, which was difficult to describe. Partial depigmentation of varying degree was noted in thirteen cases and complete depigmentation in eleven cases. The peculiar fine reticulation described previously was present in nine cases. All showed some bluish discoloration either in diffuse areas or varying sized macules.

The palms and soles showed nothing that could be definitely classed as a manifestation of carate. In four cases, there was some brownish mottling of the palms possibly due to fruit stains. In the adult males (who were laborers) hard, dry callosities were present on both palms and soles. The mucous membranes, hair or nails were not involved in any of the cases. In one case (fig. 7) with extensive complete depigmentation, there was partial canities of

the eyelashes, eyebrows and the hair of the scalp and pubes. In this case the general depigmentation involved the genitals. These were not affected, however, in any other case.

Itching, which is described by so many writers, was conspicuous by its absence in most of my patients, from both the objective appearance of the skin and the

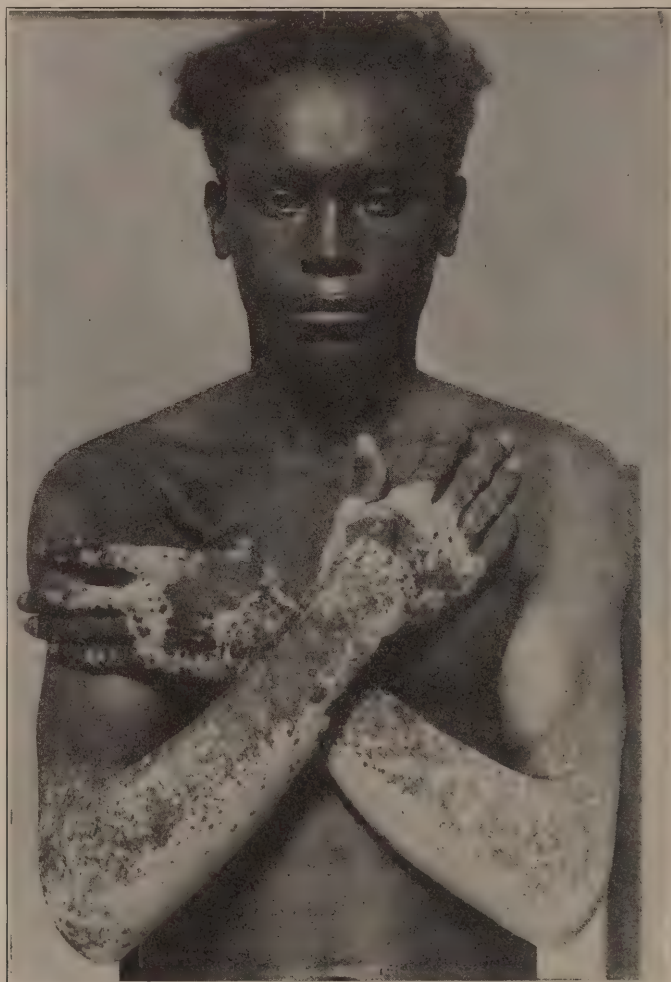


FIG. 3 (CASE 1). NEGRO, AGED 22, WITH DARK BLUISH, DIFFUSE PIGMENTATION OF NOSE, CHEEKS, FOREHEAD, UPPER LIP AND EAR (NOT SHOWN IN PHOTOGRAPH) OF TEN YEARS, DURATION

The anterior aspect of the trunk is a diffuse bluish color; the arms show well demarcated areas of partial depigmentation; the back of the forearms and hands show areas of complete depigmentation. There is not any scaling or itching.

patient's statement. It is true that a number of patients showed considerable evidence of scratching and traumatism of the legs, but they were men accustomed to doing hard work without wearing protection for their feet or ankles.

In one case there were slight ulcerations. Many of these patients showed hemorrhagic puncta from the bites of sand flies.

Another symptom which is prominently mentioned by most writers is scaling, which is said to be branny at first, later becoming lamellar. It was surprising,



FIG. 4. A MAN OF MIXED INDIAN AND WHITE BLOOD, AGED 24, WITH AN EXTENSIVE ERUPTION OF THE FACE, TRUNK AND EXTREMITIES OF SEVEN YEARS' DURATION

There are blue areas on the nose, cheeks, chin and sides of the neck. The trunk anteriorly shows fairly well defined extensive areas of partial depigmentation, mottled with freckles and larger spots of apparently normal dark color. The arms show reticulated light and dark areas, and completely depigmented patches on the back of the hands and wrists. The culture showed *Aspergillus* from two areas. Direct microscopic examination showed fungus.

therefore, to find that scaling was rather inconspicuous in the majority of my patients. In many of the extensive areas, with or without bluish pigmentation, there was little scaling and it was frequently difficult to obtain enough

scales for microscopic examination and culture except by vigorous scraping. Lamellar scaling of the legs and ankles was noted in seven cases; there was no more, however, than would be expected in laboring men not accustomed to frequent ablutions. In two cases, there was lamellar scaling on areas of the thighs and buttocks respectively which were the sites of bluish pigmentation.



FIG. 5 (CASE 1). THERE IS A SMALL AREA OF NORMAL SKIN IN THE SCAPULAR REGIONS. The middle two-thirds of the back show partial depigmentation with small islands of dark skin. The lower back shows diffuse, deep, bluish pigmentation of dorso-lumbar regions; the buttocks and the back of the arms show areas of complete depigmentation.

MICROSCOPIC EXAMINATION

Direct microscopic examinations were made from thirty separate areas of the body, in the twenty patients showing evidences of blue carate. The areas selected included those which were smooth or scaly and either bluish or in vari-

ous stages of depigmentation. When scaling was not present the affected area was vigorously curetted to the point at times of causing a slight bleeding. The skin was not sterilized before curetting was performed. The scrapings from

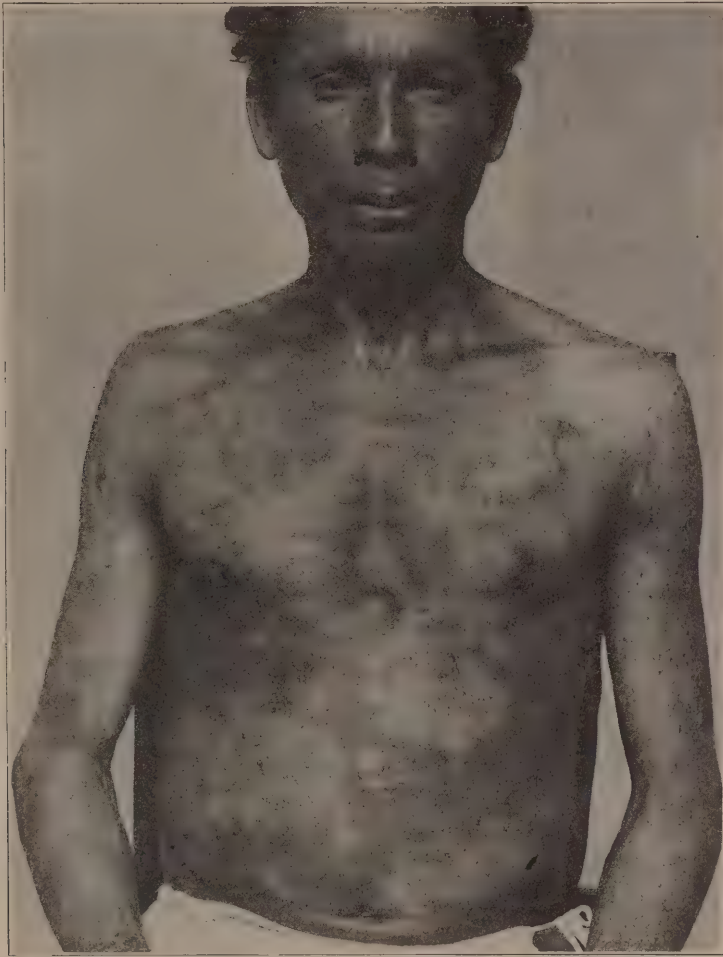


FIG. 6. A MAN WITH MIXED INDIAN AND NEGRO BLOOD, AGED 35, WITH A GENERALIZED ERUPTION OF THE FACE, TRUNK AND EXTREMITIES OF FIFTEEN YEARS' DURATION

There are areas of slight bluish pigmentation of the nose, cheeks and chin. The trunk anteriorly shows well defined partially depigmented and somewhat reticulated coalescing various sized patches, with a few brownish freckles. There are bluish scaly areas on the thighs and legs. The lower part of the legs are severely traumatized. The back shows a more marked reticulation. There is complete depigmentation on the front of the wrists and the knuckles. Cultures showed *Aspergillus* from two areas, yeast and possible *Trichophyton*.

seven patients were examined in Santa Marta, but no suggestion of fungus was found. The greater part of the material was brought to New York and examined at leisure during the course of the two succeeding months. The preparations

were made with 30 per cent solution of caustic potash, in the majority of cases gentle heat being applied to the slides. These were made and examined by my laboratory technician, Miss Avchen, who also made all of the hanging drop preparations. In spite of conscientious and painstaking search, fungus was

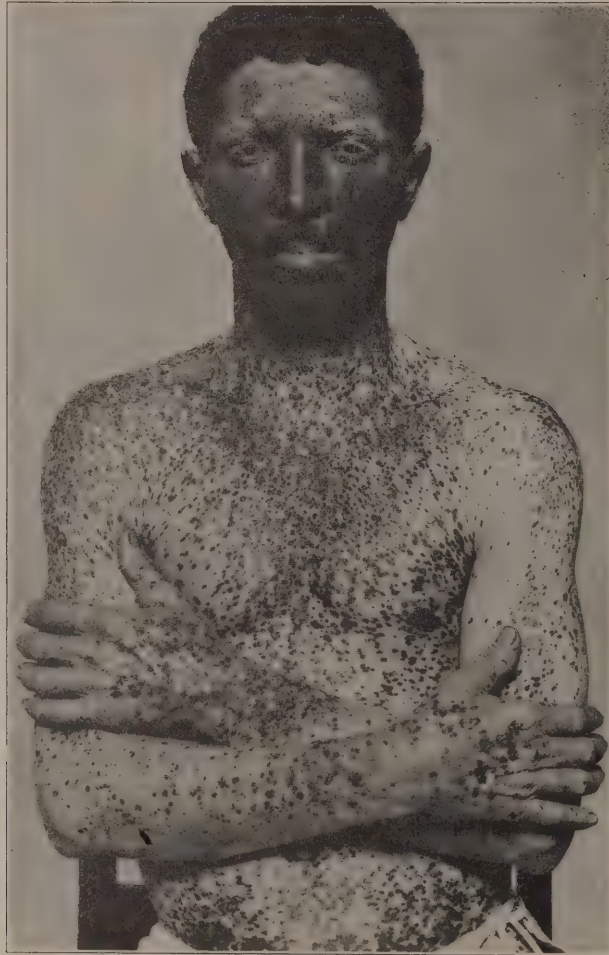


FIG. 7. A MAN WITH MIXED NEGRO AND INDIAN BLOOD, AGED 36, WITH AN EXTENSIVE ERUPTION OF THE FACE, TRUNK, NECK AND EXTREMITIES OF FIVE YEARS' DURATION

There is a large amount of complete depigmentation with dark spots varying in size from that of a pinhead to that of a coin and giving a strikingly mottled, leopard skin appearance. The face shows bluish black macules varying in size from that of a pea to that of a pinhead and tending to coalesce. The bluish color was seen also on the chest. The rest of the body shows brownish normal skin in small islands contrasting with vitiligo areas. There is partial canities of eyelashes, eyebrows and pubic hairs. The culture showed *Aspergillus* and *Stemphylium*.

found in only one of the many slides examined. In this case, a few septate hyphae were found which consisted of short quadrangular elements. It is true that some of the material was examined as late as two months after it had

been obtained, which could hardly account for the almost complete absence of fungus, though its viability for culture purposes might have been affected. Some of the slides were examined at once and others after the scales had soaked for twenty hours in the solution of potash.

The almost entirely negative results of direct microscopic examinations were a surprise to me as I had been led to suppose, from the writings of certain authors, that it was a simple matter to find fungus in an ordinary hydroxide preparation. A little later, I was interested to learn that the experience of some other observers was similar to mine. Arjona,⁶ in writing on pinta in Yucatan, stated that in this disease he never found any fungus. It should be mentioned that his description of the disease was not very convincing and his six photographic illustrations, while excellent, showed only whitish patches resembling ordinary vitiligo. Folkes⁷ stated that in his experience with pinta in Mexico "careful examination with the microscope failed to reveal micro-organisms in scrapings." Castellani,⁸ in speaking of the blue variety of pinta, said that in his limited experience with this disease in Honduras, "Fungi are not found microscopically, or only a few spore-like bodies on the surface of the epidermis." Menk,⁹ who studied cases of carate at the hospital of the United Fruit Company in Santa Marta, thought that the value of microscopic examinations was limited, for various reasons. The white areas rarely showed fungi and "it usually happens," he stated, "that the apparently diseased area in the skin is free from fungi," though he said that fungus was frequently found in scrapings from normal skin.

CULTURES

Material for cultures was obtained from sixteen of the patients presenting evidences of bluish carate. Scrapings were made from thirty separate areas scattered over the body, including smooth and scaly bluish patches and those showing various degrees of depigmentation. Cultures were also made from the skin of two patients who did not present any evidence of carate or other disease of the skin, and one tube was exposed to the air in the laboratory for two hours. Seventy tubes of Sabouraud's isolation medium (using dextrose in place of maltose) were inoculated. They were kept at room temperature at Santa Marta, at 40 F. on the ship returning home, and later grown at room temperature. Hanging drop preparations were made from all cultures that showed fungous growth.

In cultures from two areas, growth was not obtained, while the others showed growths of various fungi and bacteria, alone or in combination. The fungi

6. Arjona, Rodriguez: Beitrag zur Kenntnis des Pinta (Mal del Pinto) auf der Halbinsel Yucatan, Arch. f. Schiff- u. Tropen-Hyg. 31: 472 (Oct.) 1927.

7. Folkes, H. N.: Pinto or Overo, Med. Rec. Mississippi 1: 229 (Sept.) 1897.

8. Castellani, A.: Observations on Some Diseases of Central America, J. Trop. Med. & Hyg 28: 1 (Jan.) 1925; Arch. Dermat. & Syph. 17: 354 (March) 1928.

9. Menk, W.: Carate in Colombia, Annual Report United Fruit Company, 1926, p. 123.

which were identified as far as possible included both yeasts and molds. Dr. Fred Weidman assisted in this difficult work. Yeast was observed in four cultures. Of the molds, *Aspergillus* was decidedly the most frequent, as it was found in cultures from nine areas. Other molds in the order of frequency were as follows: *Trichophyton* (?), 4; *Macrosporium* (?), 3; *Penicillium*, 2; *Stemphylium*, *Monosporium* and *Madurella* (?), 1 case respectively. *Staphylococcus albus* or *aureus* or both were present in twelve areas and *Bacillus subtilis* in one. In two patients, who were thought by the hospital physicians to be suffering from carate, though bluish pigmentation was not present, cultures showed a combination of yeast and *Aspergillus* in one and *Helminthosporium* (?) in another. Cultures from the skin of two normal persons showed doubtful macrosporium and an unidentified mold. In nearly all of the cases, only one type of fungus was grown from scrapings of a given area, although staphylococci were frequently seen in association. The tube exposed to the air showed a growth which could not be identified.

HISTOLOGIC EXAMINATION

Biopsies were performed in five patients who showed four different types of carate, including diffuse and stippled bluish pigmentation and partial and complete depigmentation. The tissue was excised under local anesthesia, fixed in absolute alcohol and later embedded in paraffin. Sections were stained with hematoxylin and eosin, polychrome methylene blue, Ziehl's solution, Gram's stain and Weigert's elastic tissue stain. The histologic examinations were made by Dr. Walter J. Highman, whose observations were as follows:

CASE 7.—Tissue from a stippled bluish area was examined under high power (fig. 8). The epidermis was not changed in outline or thickness. The stratum corneum was thin and flaky. The rete cells (including the basal layer) were nearly all changed to vacuoles with a central nucleus, suggesting psorosperms. The epidermis showed pigmentation (which was not continuous) both from granules in the lower layers and from a considerable number of fibroblasts. The papillary layer showed slight edema, dilation of the capillaries and infiltration chiefly of the fibroblasts. The subpapillary region showed more marked infiltration in the small perivascular foci. The vessels were slightly dilated; their walls were not thickened. The perivascular infiltration consisted chiefly of fibroblasts, a few round cells and many chromatophores, which also were free in this region. The deeper corium was approximately normal. With Weigert's stain, there was an almost complete disappearance of elastic fibers from the subpapillary plexus upward. The pigment was interrupted in the basal layer, forming a broken line where the chromatophores were seen in the corium.

CASE 20.—Tissue from a stippled bluish area was examined. The observations were similar to those of case 7.

CASE 1.—Tissue from a diffuse bluish area was stained with hematoxylin and eosin and examined under high power. The epidermis showed some fusing of rete pegs in places, in others thinning to form a narrow band. A flaky hyperkeratotic scale was present. The granular layer was interrupted and extremely thin. The rete was filled with vacuolated cells. The pigmentation in basal and adjacent layers was dense. The papillary body contained a sheet of infiltration surrounding widely dilated capillaries with swollen endothe-

lium. The infiltration extended down into the subpapillary plexus and consisted of round cells, fibroblasts and a huge number of chromatophores. Below this level changes of importance were not seen. With Weigert's stain, the elastic fibers were found absent at the level of infiltration, and were approximately normal elsewhere.

CASE 3.—Tissue from a partially depigmented area was stained with hematoxylin and eosin. The epidermis was similar to that in case 7. In the infiltrated areas there were hardly any chromatophores, but a diffuse fibroblast



FIG. 8 (CASE 7). HISTOLOGIC SECTION FROM STIPPLED BLUISH AREA OF CARATE

deposit around dilated vessels. The collagen was distinctly edematous. The pigmentation of the basal layer was interrupted, being extremely dense at some points and slight or absent in others. The usual vacuoles were present. Weigert's stain showed absence of elastic fibers in the papillae and above the subpapillary plexus.

CASE 18.—Tissue from a completely depigmented area was stained with hematoxylin and eosin and examined under high power. The epidermis did not show any marked changes in contour. Scaling and the appearance of the rete was similar to case 7. The granular layer was thin but not interrupted.

Pigment was not seen in either the epidermis or corium. There was a distinct perivascular infiltration of fibroblasts and round cells without chromatophores. There was a distinct edema from the subpapillary plexus upward. Weigert's stain showed only a few fragmentary elastic fibers from the level of the subpapillary plexus upward.

Summary.—The common observations in all the sections were vacuoles in the rete, absence of elastic tissue in the papillae and subpapillary region and pigmentary dystrophy. The bluish color depended on the presence of chroma-

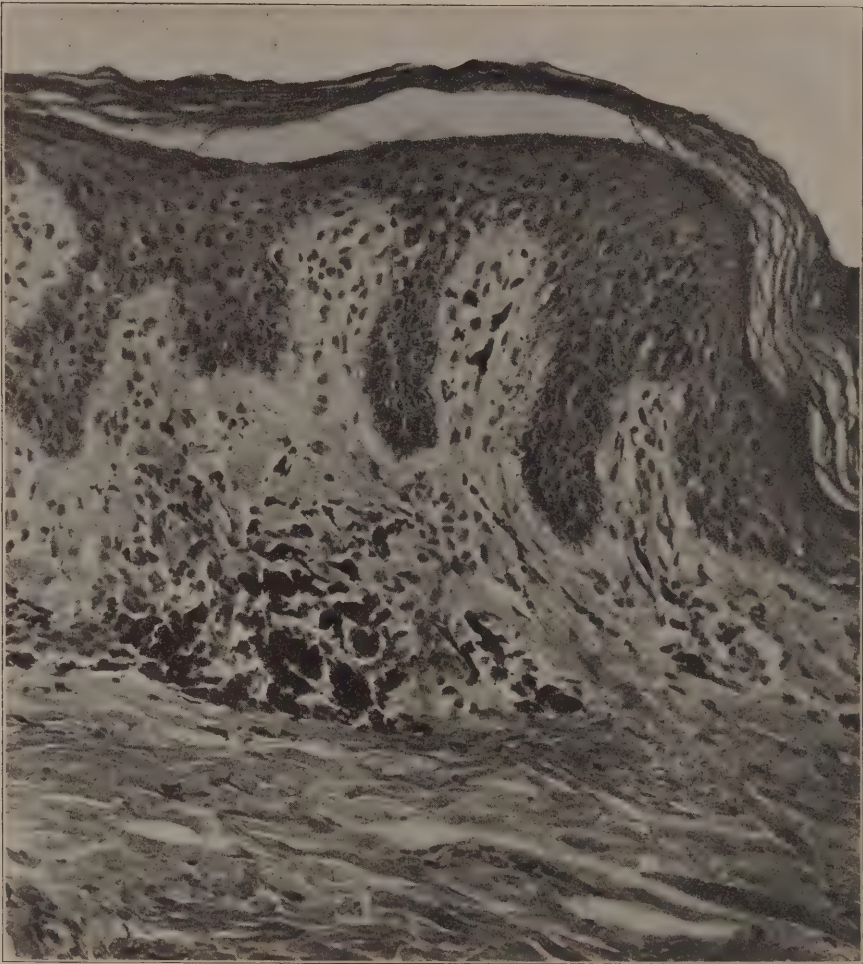


FIG. 9 (CASE 1). HISTOLOGIC SECTION FROM DIFFUSE BLUISH AREA OF CARATE

tophores as in some nevi. The process was evidently a mild inflammation leading to vacuolization in the epidermis, slight edema in the papillae and subadjacent levels and disturbance of pigmentation and elastic tissue. Sections stained with methylene blue, Ziehl's solution and Gram stain and examined with both high power and oil immersion failed to show the presence of any micro-organisms. The observations were similar to those of Toussaint,¹⁰ as

10. Toussaint, M.: Histo-patologia del mal del pinto, Bol. d. Inst. Patol. 6: 443, 1908.

described in an excellent series of articles, with colored illustrations of histologic preparations.

COMMENT

My observations on carate, made in the brief space of one week, are given for what they are worth, and this article can be considered only as a preliminary communication. Furthermore, my work was done without the assistance of

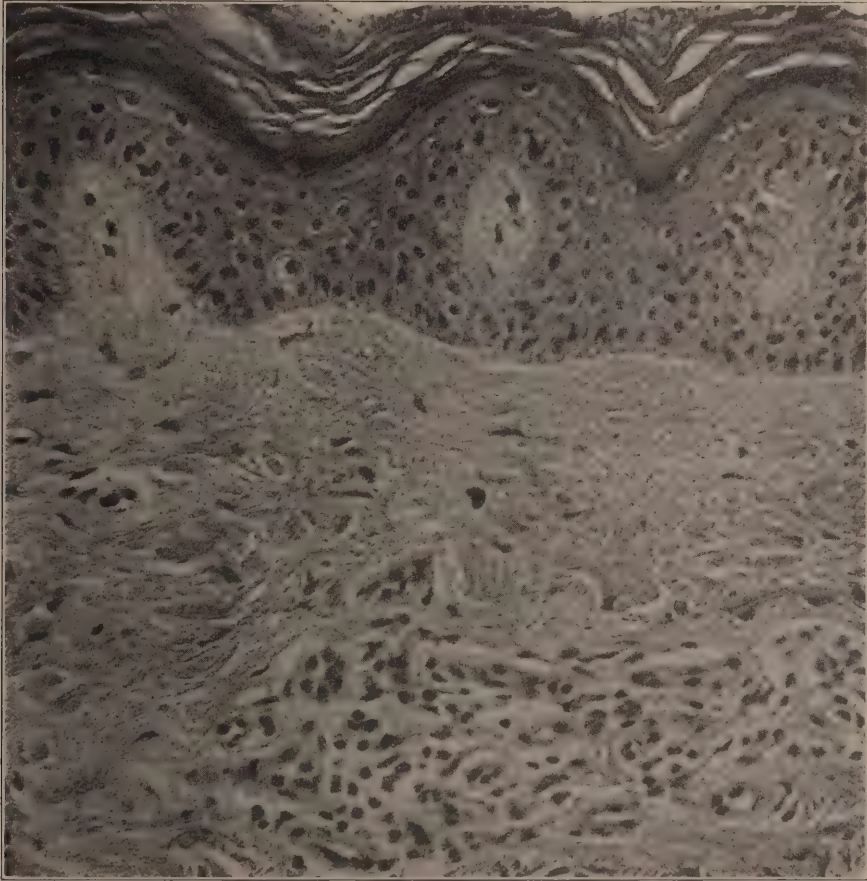


FIG. 10 (CASE 18). HISTOLOGIC SECTION FROM COMPLETELY DEPIGMENTED AREA OF CARATE

any one with expert knowledge concerning the disease. The cases which I have classed as blue carate might have been considered by other investigators as belonging to the violet type of pigmentation.

In view of the positive observations of fungi from scrapings and in sections by Chavarria and Shipley (described in their recent exhaustive report), my results are certainly disappointing, as they were almost entirely negative in this respect. It is true that various fungi, especially *Aspergilli*, were cultivated from my cases,

but their mere presence on the skin in natives of the tropics is not conclusive. Castellani says of the "bronzine" and blue type of pinta:

Cultivation methods may show absence of fungi or presence of penicillium-like, aspergillus-like and other molds identical with those which one finds at times on the skin of normal natives. The etiological rôle of these molds, so many species of which have been described by various observers, seems doubtful and as regards the cases seen by me in Honduras, the organisms were in all probability only saprophytes.

The etiology of carate is a subject which I am not able to adequately discuss. As said previously, it affects chiefly the adults of the dark races who live in certain moist regions of the tropics. Lack of proper hygiene must certainly act as a predisposing cause, while the rôle of insects (especially some species of *Simulium*) has been frequently debated. Whether the various fungi found in the skin and grown artificially are the causative agents, I do not know. The disease at least does not appear to be extremely contagious as frequently only one or two members of a large family will be affected, while soldiers in barracks do not seem to transmit the disease to others (Sandwith⁴).

Treatment is said to be efficacious at the outset by various parasiticial remedies. In the later stages, the outlook is unfavorable or hopeless. Chrysarobin in collodion is highly recommended by Urueta.³ I suggested that this remedy be tried in ointment form, and the part covered by oiled silk or some other impermeable substance.

SUMMARY

Twenty of the fifty patients with carate, observed in Santa Marta, Colombia, showed distinct evidence in some parts of the body of bluish pigmentation. In some cases the color was slaty-blue, in others bluish black. Associated with pigmentation were various stages of depigmentation and a peculiar fine reticulation or mottling. The extremities were affected in every case. In thirteen cases, the face and neck were involved. In some cases the eruption was generalized and profuse. Itching was conspicuously absent in most cases and scaling was not a prominent feature. The hair, nails, mucous membranes, palms and soles were not affected. Most of the patients were adult males of mixed Indian and negro blood.

Microscopic examinations for fungus were made from scrapings of thirty areas of the body in twenty-five cases of blue carate, including areas which were smooth or scaly, bluish or in various stages of depigmentation. In only one preparation was any fungus present (septate hyphae).

Cultures were made from scrapings of the skin of sixteen patients with blue carate. Seventy tubes of Sabouraud's isolation medium were inoculated and hanging drop preparations made from all. Yeast was grown in four cases. Of the various molds, *Aspergillus* was found most frequently (from nine areas), *Penicillium* and other higher fungi and unidentified *Trichophyton*s were grown in a dozen cases.

Microscopic examination was made of five patients who showed diffuse and stippled bluish pigmentation, partial and complete depigmentation. The observations common in all of the sections were vacuolization of the rete cells, absence of elastic fibers in the papillae and subpapillary region and pigmentary dystrophy, the process appearing to be mild inflammation. Micro-organisms were not found in any of the sections.

In conclusion, I wish to express my sincere thanks to Dr. W. E. Deeks and Dr. R. C. Connor for making it possible for me to study carate at Santa Marta, and to Dr. L. M. Drennan and his staff for their courtesy and assistance during my stay at the hospital.

LICHEN PLANUS—CASE REPORT

A. E. MOURE, M.D.

Tela Railroad Company Hospital

Tela, Honduras

The reason for reporting this case is that it is a typical textbook example of Lichen planus conforming with the classical description of the disease in its history, subjective symptoms, and size and color of the lesions, but differing somewhat as to the characteristic locations and distribution. Moreover, this disease is seldom encountered in our dispensary practice.

CASE REPORT

History.—F. M., Honduranian woman, aged 52, married, first visited the out-patient department August 25, 1928, complaining of a skin eruption on the left arm which she had had for some time, and which was resistant to all kinds of home remedies.

The family history was uninteresting. She had had 6 children—4 alive and in good health, 2 dead. The climacteric occurred at the age of 42. The personal history showed that the patient had had malaria several times, and in 1920 an attack of dysentery. In 1919 she suffered from an itch all over the body, which was accompanied by some swelling of the hands, and which lasted about 15 days. She was treated with some external remedy that contained alcohol. This is the only skin trouble that the patient remembers having had previous to the onset of her present trouble. She complained of having suffered recently from chronic constipation, this condition being followed at times by periods of abdominal cramps and diarrhoea. During the last two years, she repeatedly had severe headaches.

The skin eruption started about one month ago. The patient first noticed it on the left hand as an indurated patch that itched very much. From the left

hand the lesions slowly extended along the ulnar surface of the forearm, up the inner surface of the arm, and across the chest in the form of hard, red spots. She took no medicine nor used any cosmetic or other substance to which the appearance of the eruption could be attributed. The patient stated that the lesions had always been dry, and that no blisters nor oozing had been present.

Examination.—On examination one found that the skin on the hypothenar surface of the left hand was hard, dry, and scaly, and violaceous in color. Along the inner surface of the left forearm and arm, and across the chest on the same side, were lines of papules varying from the size of a pin-head to that of a pea.



FIG. 1

These papules were dry, glistening and scaly papular lesions, irregular in outline and of pinkish and violet tints. Some of the papules had coalesced and formed dried, irregular patches of purplish color along the forearm. There were also discrete smaller patches on the arm and chest.

Itching in the lesions was complained of and evidences of scratching were observed. When the patient was first consulted by the writer, the papules were absolutely dry; some of them had coalesced, and were of purplish color and quite different in appearance from the lesions of herpes zoster, which was suggested by the general distribution of the lesions.

On general physical examination one found a well-nourished native woman of

dark complexion. The hair was black, streaked with gray. The pupils were equal and regular, and reacted to light and accommodation. The teeth were all missing, except for 5 roots in very bad condition.

The epitrochlear and axillary glands on left side were enlarged. On the right side they were normal, as were the cervical and inguinal glands.

On examination of the chest, one found normal respiratory movements. On auscultation only a few bronchial râles in front and behind could be heard.



FIG. 2

The heart was of normal size, second sound slightly accentuated over the aortic region; blood pressure, systolic 118, diastolic 72. The abdomen was flaccid and showed the presence of lineae albicantes but was otherwise negative.—All reflexes normal.

Laboratory Report.—Scrapings taken from lesions were negative for fungi. The urine was clear and acid, with a specific gravity of 1.020; negative for albumin, sugar and casts. The examination of the blood was negative for malaria

parasites. Red-blood cells, 4,250,000; white-blood cells, 4,400. Differential count: polymorphonuclears, 41%; small lymphocytes, 45%; large mononuclears, 0%; transitional, 2%; eosinophiles, 12%; haemoglobin, 70%; blood sugar, 0.12%. Kahn reaction, negative. Examination of the stool revealed the ova of hookworms and trichuris.

Diagnosis.—Lichen planus, oral sepsis, helminthiasis and chronic constipation.

Treatment.—This consisted of the administration of strychnine and sodium cacodylate, and the local use of calamine lotion, followed later by the application of salicylic acid over the lesions. The patient was advised to lead a regular, hygienic life, and to take a well-balanced diet, with restriction of carbohydrates. The infected teeth were extracted. Oil of chenopodium was given for removal of hookworms.

Special Reports on the Case.—Tissue specimens of the lesions (papules) were sent for microscopic examination and diagnosis to Dr. F. B. Mallory, of Boston, who reported as follows:

Microscopic Examination: Shows a chronic inflammatory process involving the epidermis to a slight extent only, but in the adjoining corium are great numbers of lymphocytes, a few endothelial leukocytes, and an occasional eosinophile. The same exudate occurs around some of the coil glands and a few of the blood vessels and nerves. There is no evidence of any infection, although the photograph suggests the possibility of a lymphangitis. *Microscopic diagnosis:* Chronic inflammation.

Tissue specimen and photograph were submitted to Dr. Howard Fox, Professor of Skin Diseases, Bellevue Medical School, New York, who reported as follows:

Report on Tissue Specimen and Photograph: The tissue from the Honduran woman in whom a clinical diagnosis of lichen planus linearis was made, showed the histologic structure of lichen planus.

ELEPHANTIASIS—CASE REPORT

WALTHER JANTZEN, M.D.

Truxillo Railroad Company Hospital

Puerto Castilla, Honduras

History.—J. E. V., Honduran mestizo male, aged about 30 years. Since infancy the patient had had a partial paralysis of the left arm and foot. Three years ago the left foot and leg began to swell and slowly developed the present condition.

Physical and X-ray Examinations.—The patient was well-developed and fairly well nourished. The organs of the chest and the abdomen appeared normal. The left hand was crippled and the muscles of the left arm were atrophic. The



FIG. 1



FIG. 2

right leg, especially the lower parts of the thigh, was oedematous. The left leg, from the knee down, was greatly deformed; the patient walked on the back of his foot. The whole foot was crippled, and there were 2 deep sulci between the swollen part of the leg and the sole of the foot, which was bent upward and backward. An X-ray examination of the leg bones showed no pathological findings, but the bones of the foot were badly deformed. The blood was negative for syphilis, malaria and filaria. The patient could use his leg rather well, being able to walk several miles without great difficulty.

Outcome of the Case.—He refused to stay longer than 3 days in the Hospital and was therefore discharged without improvement.

Comments.—The case is reported because elephantiasis is rarely seen in this locality, this being the first case observed during several years. The connection of elephantiasis with the malformation of the foot in consequence of paralysis in infancy, is interesting.

The illustrations (page 175) negative the necessity of further description.

PEMPHIGUS—AN UNUSUAL CASE

ERNST THONNARD-NEUMANN, M.D.

United Fruit Company Hospital

Almirante, Panama

Preliminary Remarks.—The patient, a Panaman colored woman, about 40 years of age, was admitted to the Hospital on July 25, 1928, with a temperature of 104° and in delirium.

While examining the patient, we found her left leg in a condition resembling a burn of the second degree. It showed a moderately inflamed skin, with numerous large blebs. The lesions extended from the foot upward toward the inguinal region, where the more recent lesions appeared as distended blebs and the skin acutely inflamed. Below the knee most of the bullae were collapsed or the surfaces rubbed off. The region between the knee and the groin showed an intermediate stage—the blebs were less distended and some of them had become confluent. The blebs varied in size from that of a one-cent piece to that of a silver dollar. Their shape was generally round. They were distributed irregularly—singly or in groups over the surface—and contained a clear, serous liquid. A flat, round ulcer, the size of a quarter, with a dirty yellow base and sharp margins, was located near the inner ankle. The ulcer was surrounded by an area of intense oedema and hyperaemia, such as we often find in acute exacerbations of chronic leg ulcers.

History.—The personal history was obtained on the day after admission, when the patient's general condition had somewhat improved. She stated that she had



FIG. 1

had 3 childbirths and 4 abortions, and gave a history of repeated malaria attacks. The leg ulcer had existed, so far as she could recall, for many years, but at intervals of several months it would heal superficially and then break down again.

Physical Examination.—The patient was fairly well nourished, but the musculature was flabby. The visible mucous membranes were anaemic. The tongue was very dry and thickly coated, and the teeth were in fair condition. Both tonsils were hypertrophied and they, as well as the pharynx, were intensely congested. The lungs were negative, and the breath sounds normal with the exception of a slight roughening and a few fine moist and dry râles over the bases. The heart was slightly enlarged to the left, although its action was regular; the sounds were weak and harsh, at the apex as well as over the base. The pulse was soft and rapid; the liver could not be palpated; the spleen was tremendously enlarged, extending down to the umbilicus, and it was hard and somewhat tender.

Laboratory Findings.—Urine, reaction acid; specific gravity 1.017; albumin heavy trace; casts numerous granular

Haemoglobin, 55%

Red-blood Count, 4,200,000

White-blood Count, 8,200

Differential count:

Neutrophils, 68%

Lymphocytes, 27%

Eosinophils, 5%

Meinicke Test negative, Kahn a one plus.

Cultures of the contents of the blebs showed a small gram-negative bacillus, occasionally some staphylococci, and a gram-positive streptobacillus.

Developments.—The condition of the patient became gradually worse each day and she died on the 5th day after admission. After the 1st day, the fever did not exceed 102°, although the pulse remained nearly always above 120. Once or twice each day there was a temperature drop to normal for a short time. The patient was unconscious most of the time, either delirious or in stupor. Dullness developed over the lower lobe of the left lung, the vocal fremitus was decreased and the breathing shallow, broncho-vesicular in character, and friction râles were heard.

A considerable amount of clear, yellow fluid was aspirated from the left pleural cavity. Smears and cultures from it were sterile. The daily output of urine decreased considerably during the last 3 days, and contained large amounts of albumin and numerous granular casts. Two days before death a profuse diarrhoea made its appearance, and during the last 24 hours symptoms of pulmonary oedema appeared.

The distribution of the lesions is shown in the accompanying illustrations (pages 177 and 179). Most of the blebs had lost their contents; some through accidental rupture, others by apparent absorption or spreading and becoming



FIG. 2

confluent with adjacent ones. Before death the skin lesions had extended up to the waistline, and on to the anterior surface of the right leg.

The treatment was both local and general; boric-acid ointment was applied liberally over the affected area after opening the blebs. This treatment seemed to relieve the burning which the patient complained of. Arsenic was given in the form of sod. cacodylate by hypodermic injections, quinine by mouth and by rectum. Mercurochrome was administered once intravenously. A post-mortem examination could not be obtained.

Differential Diagnosis.—The benign course which characterizes *impetigo contagiosa* differentiates it from our case. Moreover, the large blebs rose from an apparently sound skin.

The case was distinguished from *dermatitis herpetiformis* (Duhring) by its acuteness, the uniformity of the lesions, and the lack of any tendency to form regular groups.

Erythema bullosum, a variety of the *erythema multiforme*, was ruled out because the blebs in that condition are formed by the confluence of small vesicles, and there are usually other typical efflorescences of *erythema multiforme*.

The condition was readily differentiated from a *dermatitis venenata* by the severity of the systemic disturbance and by the fatal ending.

It must be admitted, however, that the bullous form of *erysipelas* resembles closely the clinical picture of our case; but the laboratory findings negatived this diagnosis. We should have found in the lesions of *erysipelas* a different organism (streptococci or diplococci) and the blood counts should have shown a high leukocyte count with neutrophilia and the absence of the eosinophiles. The large flaccid blebs, arising from the normal skin of the other leg, two days ante-mortem, confirmed our diagnosis as that of *pemphigus*.

TROPICAL OR PHAGEDENIC ULCER

CARLOS MANUEL JIMENEZ, M.D.

United Fruit Company Hospital

Port Limon, Costa Rica

Tropical or phagedenic ulcer is one of the maladies that, along with malaria and helminthiasis, are frequently observed in hospitals in the Tropics. Therefore we have thought it interesting to describe a treatment which, although not original, has proved of considerable value in this Hospital. We deem it of sufficient curative value to recommend it to those who experience the usual difficulty of combating this disease which is encountered frequently among the laboring class in the Atlantic littoral and possibly in other parts of this country.

HISTORY OF THE DISEASE

Tropical ulcer, also called "Mozambique ulcer," was described for the first time in 1857 by Vinson who treated cases among the crew of a vessel that made the passage between Mozambique and Island of Reunion, when the disease in epidemic form attacked the entire crew. It is also called "Annam ulceration," on account of the great number of victims that it claimed among the expeditionary troops to Cochin-China. Afterward it was given different terms by the many authors who studied it in Senegal, the Guianas, and the Antilles, where it received also various local names.

Its geographical distribution is extensive. It has been recognized in all tropical regions of both hemispheres.

This malady was studied bacteriologically for the first time by Le Dantec in the French Guianas in the year 1884, and it was he who first discovered and described the fusiform phagedenic bacillus in 1896. Vincent in Algiers first discovered the spirillum or spirochete which in association with the fusiform bacilli forms the combination that is now so well known in tropical ulcer.

BACTERIOLOGY

Smear preparations from these ulcers usually show a Gram-negative fusiform bacillus 4 to 8 microns in length, and frequently also involution forms are seen, particularly when the ulcer has been treated with antiseptic solutions. Associated with the bacillus and usually in great numbers (classical descriptions to the contrary) the spirochaetae can be observed as thinner and more difficult to stain than the fusiform bacilli. Characteristically the spirochaetae are observed in varying forms in the same preparation. They generally measure from 12 to 20 microns in length and are Gram-negative. Secondary infections with streptococci or staphylococci, or both, occur.

In several cases we have observed mixed infections of the spirochaetae and the fusiform bacilli with *Leishmania tropica* organisms.

Because of the successful results obtained in eliminating the associated spirochaetae and fusiform bacilli found in Vincent's angina, we have put into practice a somewhat similar treatment for phagedenic ulcers.

ASPECT OF THE ULCER

Because of their similarity the diagnosis of tropical leg ulcers is frequently confused with Leishmania, varicose, phagedenic, chancroidal and syphilitic ulcers. However, these ulcers should be suspected if we take into account the location, which is almost always the lower third of the legs or the dorsa of the feet. It is exceptional to find the true tropical ulcer on other parts of the body.

Furthermore, the ulcer generally begins with a pustule which is transformed within a few days into an ulcer, and which extends rapidly both superficially and in depth. Two conditions seem necessary also for the development of the

ulcer; first, a blow, scratch, or superficial wound causing solution of continuity of the skin; and second, the exposure of this wound to infected damp floors or mud.

Such wounds or abrasions occur frequently among our laborers. They work in the swamps and bush, barefooted, and this fact may explain the location of the ulcer.

With the beginning of its development the patient complains of some pain and a burning sensation at its site which is at times sufficient to prevent rest. When the ulcer has fully developed, its aspect is fairly typical. The contour is round and the edges regular and indurated. The base of the ulcer is uneven (apparently owing to purulent infection) and covered with sphacelous masses forming yellowish or greenish sloughs which emanate a characteristic foul odor.

The ulcer will at times invade the muscles and tendons, causing severe destruction. I have seen one instance in which articulation between the first and second phalanges of a toe was invaded and spontaneous amputation occurred.

In our experience ulcers are rarely single in occurrence. They are usually multiple, varying in numbers on the same limb.

We have also observed that these ulcers usually manifest a purely local character of infection. There is seldom any lymphatic gland involvement, and if it does occur, it is never serious, nor does it go on to suppuration.

The ulcers appear to exist in two types, one of slow evolution (atonic forms) and the other of a malignant type, phagedenic and gangrenous. Ulcers of the latter type in a short time are so destructive that amputation of the affected limb may be necessary to arrest the ascending tissue destruction. Both types have been observed in succession, in the same individual. A patient was treated in this Hospital on several occasions for an atonic tropical ulcer, which healed in a short time under treatments, and the patient was permitted to work during the intervals of its remissions. Finally, when he was again admitted for treatment, the ulcer had extended in such a manner that it had literally dissected the muscles off the fibula and had spread with such rapidity that the amputation of the leg was the only means of arresting its extension. These malignant forms are generally accompanied by high fever, whereas the atonic forms are apyretic.

TREATMENT

The treatment employed in this Hospital consists, first, in bathing the ulcer with Dakin's solution to get rid of the saprophytic infection; then local applications of gauze saturated with a solution of 4% neoarsphenamine in glycerine, which is allowed to remain in contact with the ulcer. This local treatment is supplemented with a series of 5 or 6 neoarsphenamine injections, and also a tonic of iron, arsenic and quinine to build up the general condition of the patient, who is usually debilitated from chronic malaria, improper diet, or hookworm infection. Routine blood and stool examinations are made and appropriate treatment is instituted if findings are positive.

The results obtained to date have been very gratifying: The ulcer is rapidly cleaned, the pain and the foul odor disappear, and the base of the ulcer soon begins to granulate, this process being followed by normal healing and cicatrization.

The results obtained with the method of treatment described above are relatively satisfactory, as compared with those obtained formerly when ulcers were treated simply with local disinfectants over a long period of time with little or no beneficial effects; and we feel that some good has been accomplished, despite the fact that the aetiology is still a mystery.

CUTANEOUS LEISHMANIASIS

ARNOLDO LACHNER CHACÓN, M.D.

United Fruit Company Hospital

Limon, Costa Rica

PRELIMINARY DISCUSSION

The Protozoa of the species *Leishmania*, more properly called the Monozoa of the genus *Leishmania*, denominated *Leishmania tropica*—which in the south of Europe, northern Africa and Asia Minor produce the cutaneous lesions known as bouton d'Orient, Delhi boil, Aleppo boil, bouton de Bagdad, etc.—in Central America and some regions of South America produce lesions of a more malignant character. This disease, which might be designated "American leishmaniasis," is identical or similar to the so-called "boubas" of Brazil and Paraguay and the "espundia" of Central America. It quite frequently produces multiple ulcerations of large extent and of greater chronicity than the bouton d'Orient.

While the latter heals spontaneously within a period of two years, the lesions produced by the former or American type of leishmaniasis may remain for a period of thirty or more years without showing any tendency to reduction in size. Another peculiarity of American leishmaniasis, not observed in oriental sore, is the tendency to invade the nasal mucosa, the pharynx, the conjunctiva, and even the cornea, producing great destruction of tissues and resultant deformities, especially in the nasal bones. The clinical aspect of these cases is similar to that of leprosy.

It appears that the frequent incidence of cutaneous leishmaniasis in Central America has not been so far reported, nor investigated until recently. The extreme similarity of the ulcerations to those of tropical phagedena, in their appearance and localization, has probably been the reason for classifying leishmaniasis with tropical phagedena. The object of this article is to call attention to the prevalence of the disease. In this Hospital 20 cases of *Leishmania* were

diagnosed and treated during the year. Four were mixed infections with the spirochaetae of Vincent. A careful and systematic microscopical examination of scrapings from all ulcers has shown that between 40% and 50% are due to leishmaniasis. Heretofore these ulcers have not been given sufficient study for proper identification and classification.

The differential diagnosis is quite important, for while those ulcers due to spirillae respond to the arsenical treatment (salvarsan), in leishmaniasis *antimony* is the therapeutic agent on which we must rely.

The clinical aspect of the ulcers is similar to that seen in phagedenic ulcers; the small ones and those of medium size are circular, while the large ones are very irregular in shape. The bottom of the ulcer presents bloody granulations covered with foul yellowish mucopurulent discharge; the granulations often surpass the level of the circumscribed skin. The borders are bulged, irregular and undermined. The neighboring skin of old ulcers becomes atrophic, is lustrous, very sensitive, and deprived of hair.

As in phagedena, oedema of the organ attacked by the ulcer and also regional adenitis are observed quite frequently.

The localization of the ulcers is much more commonly observed in the legs than elsewhere, especially in the middle and lower third and frequently along the tibia. Nevertheless ulcers of the face (ears, nose and lids) and also of the toes are not uncommon.

MANNER OF TRANSMISSION

Recently, in this Hospital we have observed a case where the ulcer had invaded the whole nose, forehead, both lids of the left eye, and the cornea. The granulations covered so much of the lids that the vision of the eye was impaired. Although the parasitic agent of the infections has been well established, the manner of transmission still remains unknown. The hypothesis that infection may be transmitted by flies or mosquitoes is the one that has won most supporters, because the ulcers are located generally on the exposed parts of the body. However, I have observed ulcers of the feet in patients who assured me that they always had worn shoes. Traumatism undoubtedly plays an important rôle as a starting point of the infection. This observation I consider of importance and worthy of further investigation. In the majority of cases of traumatism, the patient gave a history of having done some work in mud and polluted water, without protecting the wound.

TREATMENT

The treatment consists of local applications to the ulcers and internal administration of drugs. The local treatment is necessary to rid the ulcers of other bacterial infections which are always present. We have used the wet compresses of Dakin or bichloride of mercury, alternated with mercurochrome.

Salts of antimony may be considered as specific in the treatment of this dis-

ease. The intravenous injection of tartar emetic, in doses of from 0.08 gm. to 0.1 gm. has given excellent results.

Recently the I. G. Farbenindustrie, Leverkusen, of Germany, has placed on the market two organic compounds of antimony—one a pentavalent and the other a trivalent preparation—Stibosan and Antimosan. It is claimed that their toxicity is 2-1/2 times less than tartar emetic. The Antimosan has the advantage over the Stibosan of being prepared in aqueous solution, while the Stibosan comes in powder and its solution is difficult to prepare. So far, we have not been able to detect any toxic manifestation produced by these two preparations. As to their therapeutic merit, the time has been so limited since we began their use that we are not yet in a position to compare results with those obtained from tartar emetic.

MOSSY FOOT—A CASE REPORT

E. I. SALISBURY, M.D.

United Fruit Company Hospital

Limon, Costa Rica

The term "mossy foot" was applied by Wolferstan Thomas to a papillomatous or verrucose condition of the feet and legs which is found in natives of Tropical America. The lesions may be individual or multiple, even to the complete incrustation of the affected part by a dense wart-like, vascular and painful growth.

The general appearance has been compared to dry moss growing on rocks, but this description is misleading as often the lesion is solitary and of a spur or barnacle-like nature.

The disease is of great chronicity and takes years to develop.

The exact aetiology was unknown until 1915, when E. M. Medlar,* of Boston, discovered a fungus in a case under study; and his observations were later confirmed in 1920 by Pedroso and Gomes, in Brazil. R. Thaxter classified this fungus as a new genus and this species as the type species, as given in the following table:

Branch Thallophyta.

Class A. The Algae.

Class B. The Fungi.

Order I. Myxomycetes.

Order II. Phycomycetes.

Order III. Ascomycetes.

* The Journal of Medical Research, Volume XXXII, No. 3 (New series, Vol. XXVII, No. 3), pp. 507-521, July, 1915.

Order IV. Basidiomycetes.

Order V. Hyphomycetes.

Family I. Mucedinaceae.

Family II. Dematiaceae.

Division I. Phaeosporae.

Subdivision XIV. Chalareae.

Genus 1. Conioscypha.

Genus 2. Chalara.

Genus 3. Thielviopsis.

Genus 4. Cirromyces.

GENUS 5. PHIALOPHORA, NOV. GEN.

SPECIES I. VERRUCOSA, NOV. SP.

CASE REPORT

History.—J. M. C., aged 68, colored, a native of Jamaica, was admitted to this hospital from one of our farms.

He complained of frequency of urination, passing of large quantities of urine, and of extreme weakness.

Physical Examination.—On examination he was found to be extremely emaciated, and his skin was dry and scaly. On the outer side of his right foot, just above the heel, he had a horny-like spur which he said had been present for the past six years.

The tumor mass measured about 2.5 cm. in diameter, and 2.0 cm. high. It appeared to be composed of a keratoid material, was very friable, and had a moist, ulcerating crater.

Laboratory Examination.—The laboratory examinations of the patient's blood and excreta showed nothing of interest except sugar in large quantities, and the patient was treated for diabetes.

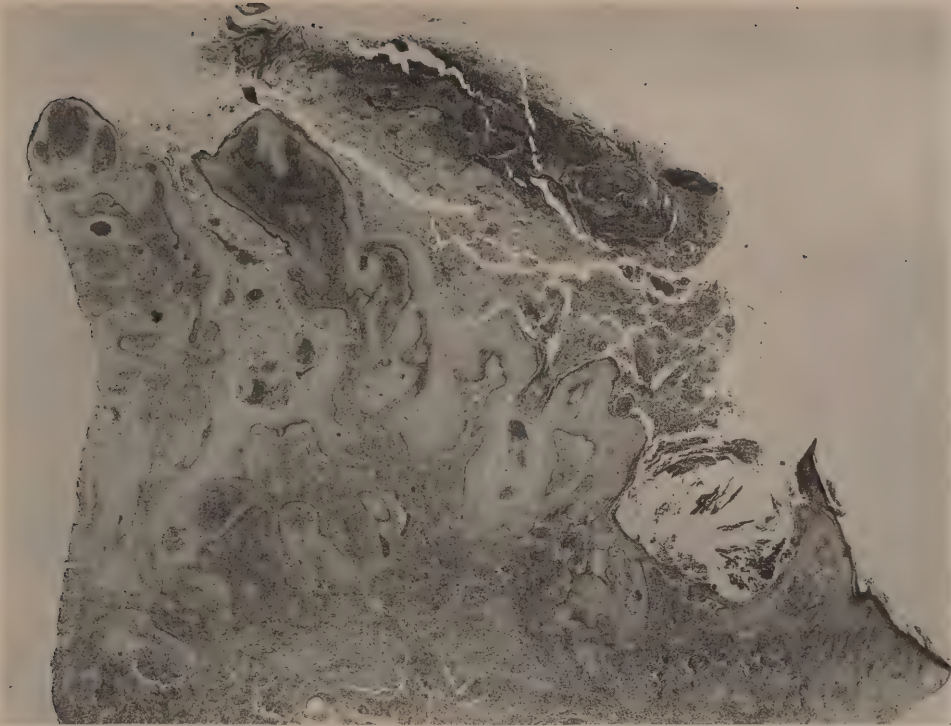
Smears taken from the tumor mass showed only a few saprophytic bacteria. They were negative for Leishman bodies, *Bacillus hansenii*, Koch's bacillus, and *Spirilla*.

Cultures taken from the tumor, on Sabouraud's media, showed at the end of a week a growth distinct from the accompanying colonies of *Staphylococci*.

Treatment.—The spur or tumor was removed with the aid of local anesthesia.

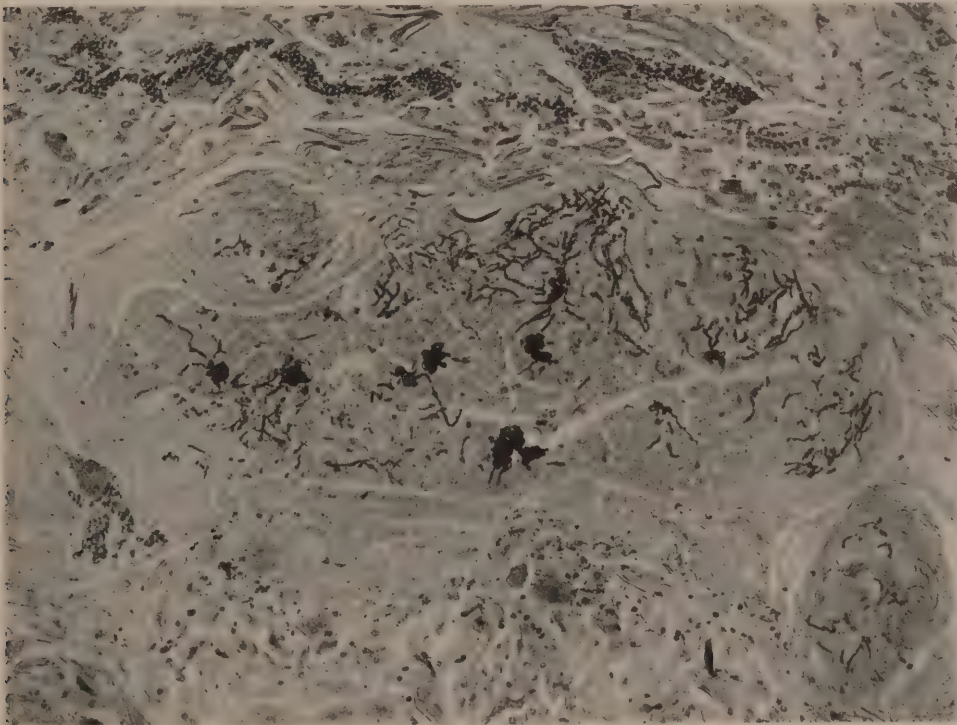
Pathological Examination.—The mass was preserved in Zenker's fluid and forwarded to Dr. F. B. Mallory, Consulting Pathologist for the United Fruit Company, who submitted the following report:

Microscopic Examination: Shows a papillary epithelial growth in which there is marked inflammatory reaction involving both the epidermis and the underlying tissue. There are numerous small abscesses containing polymorphonuclear leucocytes and varying numbers of eosinophiles, also occasionally a foreign body giant cell. Between the abscesses the tissue is infiltrated with large numbers of lymphocytes and plasma cells. Abscesses are present also



1. A LOW POWER VIEW OF THE LESION SHOWING ITS VERRUCOUS CHARACTER

There are masses of cornified epithelial cells between the papillary outgrowths and much inflammatory reaction in the submucosa. $\times 10$.



2. ABUNDANT GROWTH OF SEPTATE HYPHAE AND SCLEROTIC CELLS IN THE MASSES OF CORNIFIED EPITHELIUM BETWEEN THE PAPILLAE. $\times 170$

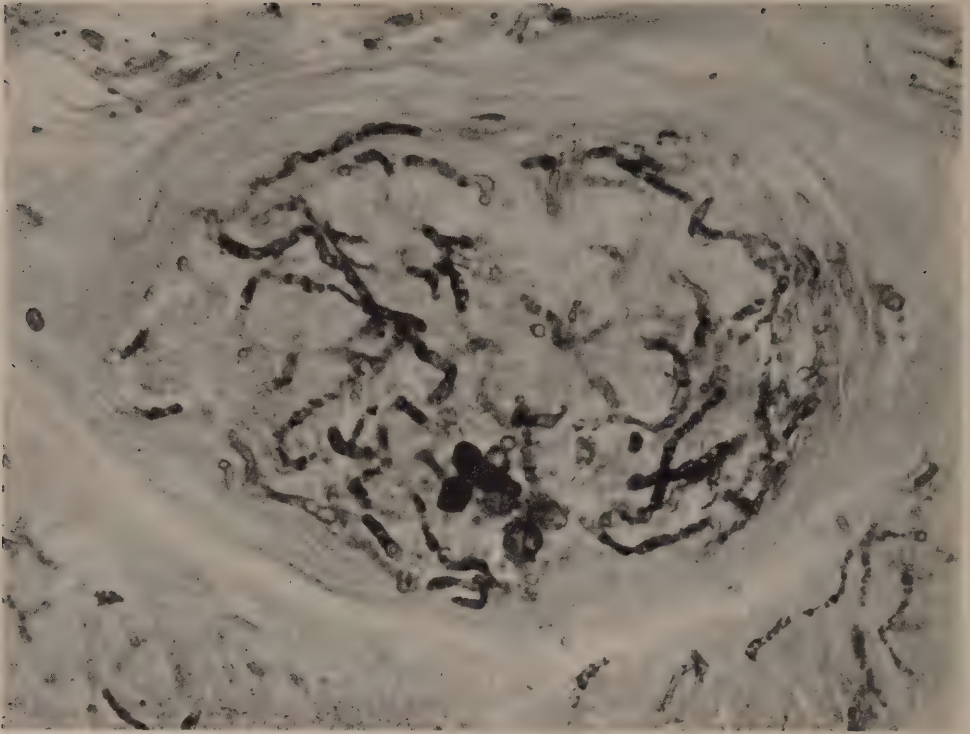


FIG. 3

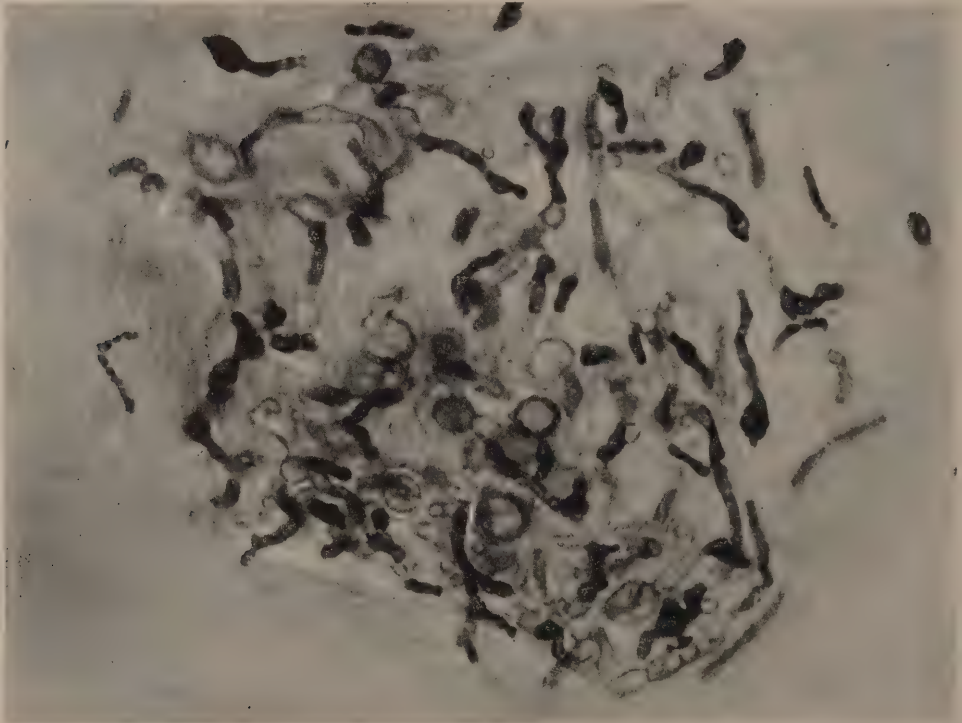
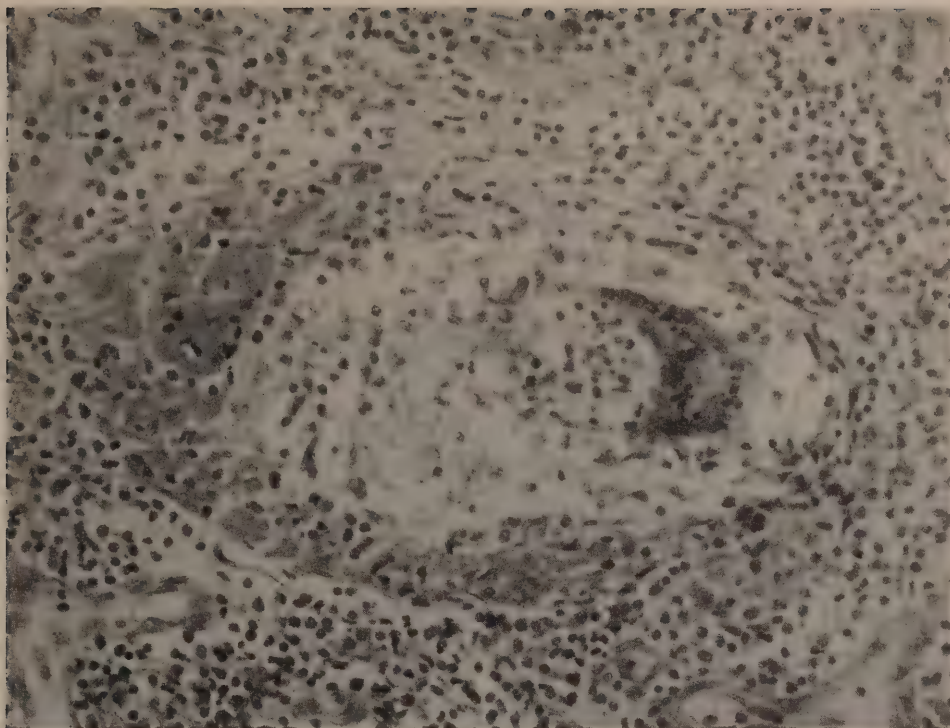
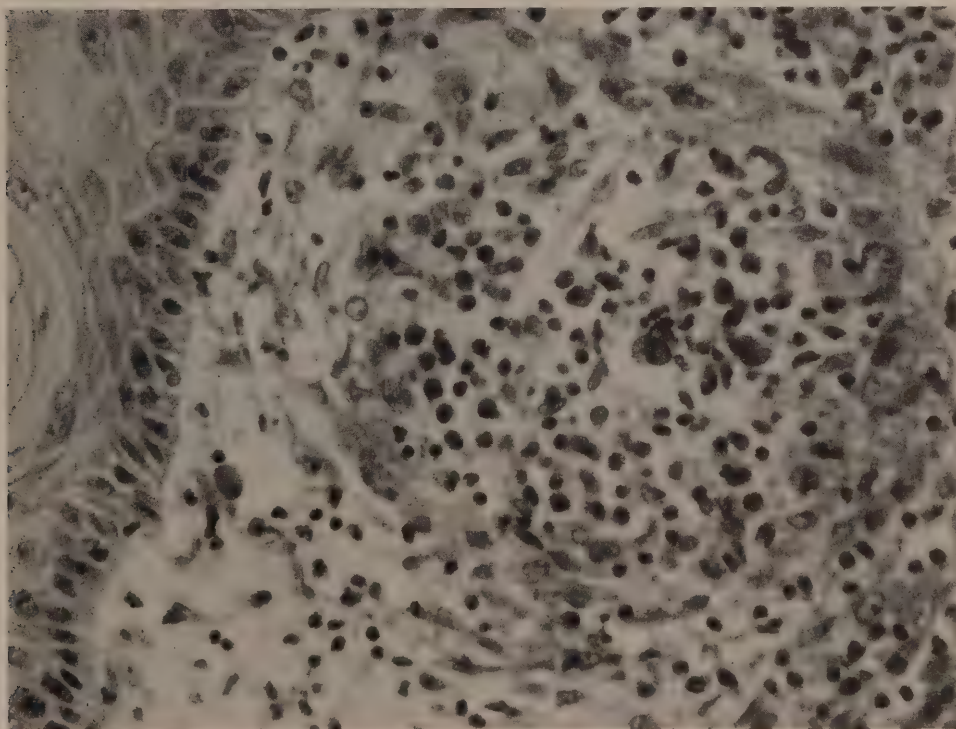


FIG. 4

3 AND 4. HIGHER POWER ILLUSTRATIONS OF THE ORGANISMS GROWING IN THE CORNIFIED EPITHELIUM.
(3) $\times 600$. (4) $\times 750$



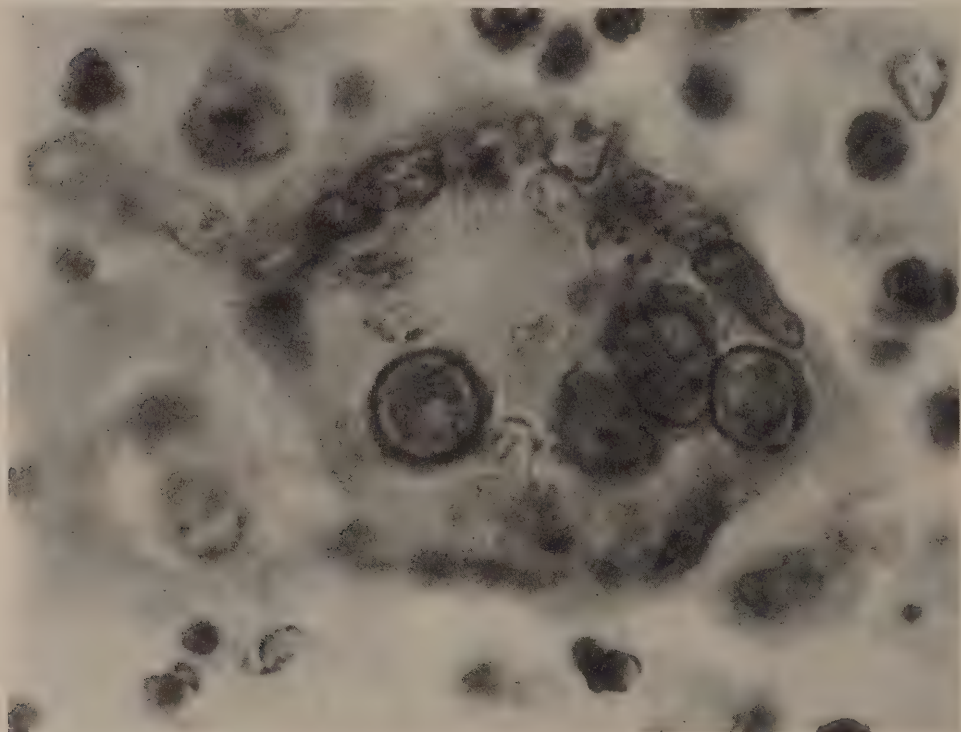
5. MILIARY LESION IN THE CORIUM SHOWING POLYMORPHONUCLEAR LEUCOCYTES AND A FOREIGN
BODY GIANT CELL
In the latter can be seen one organism. $\times 300$



6. MILIARY LESION IN THE CORIUM CONTAINING IN THE CENTER A SMALL CLUMP OF ORGANISMS.
 $\times 500$

in the epidermis. The lesion is due to a parasite of a brownish color. It appears in the lesions as spherical bodies occurring singly and in small clumps, either free among the polymorphonuclear leucocytes or enclosed in the giant cells. In one or two lesions in the epidermis numerous brownish mycelial threads are associated with the spherical bodies.

Microscopic Diagnosis: The case closely resembles one described by E. M. Medlar, due to *Phialophora verrucosa*.



7. A FOREIGN BODY GIANT CELL CONTAINING SEVERAL ORGANISMS. $\times 2000$

Appreciation is herewith extended to Dr. Mallory for salvaging this interesting find from a specimen sent to him in a routine manner for examination and identification. I am indebted to him also for the 7 photomicrographs* which appear on pages 187 to 190.

* DESCRIPTION OF ILLUSTRATIONS.—In Figs. 2, 3 and 4, the organisms were stained by the Gram-Weigert method using equal parts of aniline oil and xylol as the decolorizing agent. The other sections were stained by hematoxylin and eosin.

ORIENTAL SORE

R. B. NUTTER, M.D.

Tela Railroad Company Hospital

Tela, Honduras

The occurrence of cutaneous leishmaniasis is not infrequent in this clinic, but the case illustrated on this page is the first that we have observed with multiple



MULTIPLE LESIONS OF CUTANEOUS LEISHMANIASIS

lesions. The treatment employed is intravenous injections of 1% solution of tartar emetic every 3rd day, beginning with 1 cc. and gradually increasing to 4 cc. The results are very satisfactory.

Contrary to the teachings of some authorities, we have not been able to deter-

mine any advantage in preparing a fresh solution for each injection, nor any disadvantage in sterilizing the solution by boiling.

NOTES ON RESULTS FROM USE OF MERCUROCHROME

R. B. NUTTER, M.D.

Tela Railroad Company Hospital

Tela, Honduras

I. DIPHTHERIA CARRIERS

Summary of Methods.—In the Tela Hospital Clinic in 1928 diphtheria carriers were treated with antiseptic gargles until 2 or 3 negative cultures were obtained, with intervals of from 3 to 4 days between cultures.

Three of the carriers were very refractive and showed positive cultures after several weeks of the usual treatment. Their tonsils were hypertrophied and fissured. Two of them were later treated with applications of 5% tr. iodine, 15% solution silver nitrate, and 25% argyrol, at different times, but cultures taken the day after each treatment remained positive. Finally mercurochrome was used, and after 2 applications of 2% solution, 2 negative cultures at 3-day intervals were obtained from each of the 3 patients. We have had no opportunity to make further investigation, but in the instances cited the results were striking.

II. MERCUROCHROME IN COMPOUND FRACTURE WITH *BACILLUS WELCHII* INFECTION

Symptoms and Treatment of the Case.—A farm overseer, aged 53, was admitted to the Hospital 3 hours after being thrown from a motor-car. He had landed on his face and left arm, sustaining a compound fracture of the humerus 2 inches above the elbow, with extensive laceration of the soft parts, as well as severe haemorrhage. (The same arm had been fractured into the elbow joint 15 years before and had healed with complete ankylosis of the elbow joint in extension.) Gauze soaked with 2% mercurochrome was inserted in the compound-fracture wound for drainage. The following day the drain was removed, and a profuse discharge, with very foul odor, was present. Considerable swelling was also in evidence, with distinct air crepitus reaching to the axilla. The temperature rose to 103°; pulse 142, soft, irregular and intermittent. A culture was made and a mercurochrome gauze drain inserted again. It was apparent that we were dealing with a gas bacillus infection in a patient who, on account of age, obesity and shock, was an exceedingly poor surgical risk that would probably not survive an amputation through the shoulder joint. On the following day the crepitus

had disappeared and there were no gas bubbles in the discharge, but the patient's general condition was not improved.

Laboratory Reports.—The first laboratory report on the culture showed *B. coli* infection, and operation was postponed. Subsequently the culture was reported as positive for *B. welchii* infection. We attribute the probable cause of the delayed growth of this organism to the presence of mercurochrome used in the treatment of the wound prior to culturing the exudate.

Successful Termination.—The patient's general condition was not improved, but the local appearance of the arm was better. The temperature remained at 103°; pulse 120 to 150, poor quality.

On the 6th day the temperature dropped to 98°, pulse 88, and the swelling had subsided. There was very little pain, and surgical interference no longer was considered necessary.

Conclusions.—I do not recommend conservative treatment in *B. welchii* infections, but we were governed by unusual circumstances in this particular case, and it is fair to presume that the virulence of the organisms was so reduced by the mercurochrome applications that recovery became possible without surgical interference.

The following observations were made by Mr. J. C. McDaniel on a culture from a gas-bacillus infection which had been treated with mercurochrome:

Patient, E. C. A., admitted to the Hospital Jan. 8, 1929.

Wound, left arm.

Jan. 9th, the wound was packed with a gauze sponge saturated with mercurochrome (2%). Jan. 10th, this sponge was removed and material scraped from it was used for making cultures and also slides for microscopic examination.

Microscopic examination showed staphylococcus, a Gram-negative bacillus, and a large encapsulated Gram-positive bacillus.

After 24 hours cultures showed *B. coli* and *Staph. albus* (aerobic). Anaerobic cultures showed the same with a scant growth of the Gram-positive bacillus. The amount of gas produced was not in excess of that produced by *B. coli*.

Sub-anaerobic cultures were made which at the end of two hours revealed the presence of gas. At the end of 6 hours all media were considerably broken up by gas bubbles, and on examination the following day gas formation was typically that produced by *B. welchii*. Microscopic examination revealed this organism in abundance, whereas in the original cultures only a very scant growth could be observed.

We attribute this lack of growth in the first cultures to the presence of mercurochrome. The sponge from which the media was inoculated being saturated with the drug, a considerable amount of it was also carried along into the cultures.

APPARENT CURE OF PURPURA HAEMORRHAGICA WITH
BOTHROPIC ANTIVENIN

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PRELIMINARY REMARKS

True haemorrhagic purpura is a disease entity met with infrequently in tropical America, only a single case being on record in the Guatemala Division. Borderline cases of malaria with haemorrhagic manifestations are, of course, comparatively common. In the Honduran divisions, on the other hand, purpura haemorrhagica has been met with not infrequently, and dealt with *secundum artem*. The result of the usual treatment—like that in temperate zones—has been uniformly doubtful, and often entirely unsatisfactory. Whole-blood transfusion has generally been regarded as offering the greatest hope of relief, but the result of this expedient is not always to be relied upon and, even if the result is good, it all too frequently proves short-lived. The strikingly gratifying effect secured in the present instance has prompted this case report, with the expectation of furthering adoption of the treatment employed.

CASE REPORT

History.—H. A., 2,535, white male, aged 21, a midshipman on the Argentine training ship, *Presidente Sarmiento*, was entered in Quirigua Hospital on October 4, 1928, having been brought to port at the request of the senior medical officer. The latter believed the case to be one of “fulminating typhoid fever,” but expressed himself as unsatisfied with the diagnosis. The patient had become ill 7 days previously, with what was pronounced to be *grippe*. On the 3rd day the temperature was 39.8°C. and very severe epistaxis occurred. This necessitated emergency anterior and posterior tamponage. On the succeeding day total haematuria had supervened, as had epistaxis, and they both continued in evidence. Normal horse serum, calcium chloride and ergotin had been employed in unsuccessful treatment.

Examination and Diagnosis.—The patient was in fairly good condition, with pulse 100. There was still abundant epistaxis, partially controlled by anterior and posterior nasal packing. The gums bled profusely and continuously, and back of the chest was covered with deep, confluent purple circles where cupping had been practiced. The sites of hypodermic injections on the legs and arms were also purpuric. Only a single “spontaneous” purpuric area was presented, a spot 1 cm. in diameter on the left thigh. The first urine passed consisted

largely of blood, as did the stools. Haemorrhagic purpura was diagnosed, and the diagnosis was concurred in by Dr. Neil P. Macphail.

Preliminary Treatment and Results.—Blood examination for malaria was negative. As a precaution, quinine dihydrochloride grs. viiss was administered intramuscularly. For haemostatic effect, 5 cc. of "Haemostatic Serum" (Lapenta) were given intravenously, followed by 10 cc. of a 10% solution of calcium chloride. These measures, despite repetition, had no effect upon the bleeding. On the night of admission, haemorrhage from the nose became so severe that removal of the packing and tamponade were carried out. The bleeding during this procedure was of a spectacular nature. Fair haemostasis was secured by tight packing soaked in perchloride of iron, though this measure caused a distressing degree of pain. Adrenalin applied locally to the nasal and gingival membranes proved valueless.

On the following morning, bleeding from the gums increased and a steady trickle of blood emerged from the left nostril despite forceful repacking. The pulse was 112 and weak, respirations were shallow and sighing, the skin was cool and very moist. At about noon a large quantity of blood was vomited, and a short time later a fresh-blood stool was passed. The urine continued to consist almost in its entirety of blood. The blood-coagulation time was 4 minutes and 45 seconds, bleeding time 9 minutes and 30 seconds. RBC 2,800,000; WBC 7,600; HB. 45%. Unfortunately, materials were not at hand for platelet count.

Bothropic Antivenin Used.—Preparations had been started for a blood transfusion as a life-saving expedient, when Dr. H. C. Clark suggested the use of bothropic antivenin. The venom of the fer-de-lance or Barba amarilla (*Bothrops atrox*) is reported to contain hemorrhagin and hemocytolysin. It is said to act on the endothelial cells and the capillaries, as well as on the proteins of the red cells, permitting subepidermic infiltrations and hemorrhages into the internal organs or through the mucous membranes generally. It was not known whether the bothropic antivenin contained an anti-hemorrhagin or thrombinogenic activity. Nevertheless, it was thought that the use of the serum would do no harm and would not greatly delay the intended blood transfusion. An injection of 10 cc. of bothropic antivenin was therefore given intramuscularly at 1 P.M. Within a period of 2 hours, the bleeding from the gums and nose had stopped. On the following morning the nasal pack was removed, without incident. Red corpuscles and haemoglobin were detected in the urine for 2 succeeding days, although clinical cure was nearly instantaneous. Convalescence was not marred by relapse, although that possibility had been feared. Discharge was effected on October 17.

CONCLUSIONS

Two weeks later the patient reappeared, with an accidental gunshot fracture of the right little toe. Amputation was accomplished under local anaesthesia,

with no unusual bleeding. Observation of the patient continued until November 20th, at which time he was finally discharged.

The astonishing haemostatic action of bothropic antivenin in this case was very gratifying. It is hoped that the case will stimulate the application of this method of treatment in a sufficient number of cases to clearly determine its usefulness in patients with a haemorrhagic diathesis.

CHRONIC STREPTOCOCCAL GLOSSITIS OR ISOLATED NEURALGIA OF THE RIGHT LINGUAL NERVE

A CASE REPORT

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History.—V. de C., Salvadoranean male, aged 54 years. The patient first came to the dispensary for treatment in June, 1927. He complained that he had had increasing trouble in the middle part of the right margin of the tongue since April, 1926. The disease had started with burning and biting sensations in this region, and the right side of the tongue was swollen. Later on, this sensation had become painful, especially when he ate spicy or hot food and took liquids. He had consulted several doctors, but without securing relief. The patient was the father of 8 healthy children. Except for malaria and haemoglobinuric fever, he had never been sick previously.

Physical Examination (June 1927).—The patient, a very intelligent man, was fairly well developed and nourished; the teeth were in good condition, and the tongue showed no swelling, ulceration or fissure. The tonsils were normal, also the organs of the chest and abdomen. Blood pressure, systolic 100, diastolic 50; Hb. 90%. Erythrocytes, 4,000,000; leukocytes, 13,000; neutrophils, 62%; lymphocytes, 26%; eosinophils, 12%. No abnormal forms of red-blood corpuscles were found. The Meinicke test for syphilis was negative. The urine showed a trace of albumin, and a few pus cells in the sediment. The nervous system was normal.

Diagnosis.—The complaints first raised the suspicion that we had to deal with a "Hunter's tongue" as the beginning symptom of a pernicious anaemia, but this diagnosis was not tenable on account of the blood picture. The general conditions excluded a neurosis. Local causes which could explain the disturbance could not be discovered. The diagnosis rested between a glossodynia, secondary to a neuralgia of the n. lingualis, or a chronic streptococcal glossitis with infection of the nerve endings beneath the epithelium of the tongue (see Osler, "Mod-

ern Medicine," Vol. 3, p. 270). The differential diagnosis remained inconclusive without operative procedure. The cultures of the serum, removed by means of a syringe from beneath the inner surface of the tongue, were negative.

Development and Therapy.—Several antineuralgic drugs in various combinations with and without morphine were used, but with only temporary relief. The burning sensations developed into constant pain, which was aggravated by chewing, and later on also by speaking. Local treatment of the tongue with Dakin's solution, borax-glycerin, iodine, etc., had no effect whatever.

An intravenous injection of mercurochrome did not bring any improvement. In the meantime the patient had gone to a dentist, who removed all of the teeth of the right lower jaw, but the operation gave no relief. At the beginning of June, 1928, the pain had become so severe that the man could eat and drink only when under the influence of morphine. The pains were described as being sometimes like electric blows, and at other times like cramps or the pricks of many needles; they were always localized in the right half of the tongue, particularly in its margin. The patient was in a deplorable condition. He lost much weight and could not sleep. An x-ray examination of the jaw revealed nothing which might be considered responsible for the condition. As a last resort, a blockage of the right lingual nerve was made. An injection of butyn into the region of this nerve revealed that it was possible to relieve the pain for several hours. The treatment was therefore repeated the next day and was followed by an injection of 5 cc. of 96% alcohol. This therapy proved most efficacious. There was no more pain and apparently the patient recovered completely. Only a slight numbness in the right margin of the tongue was felt. This favorable result lasted 7 months. Slight pain recurred in the following January and slowly became more severe. Another injection of alcohol brought complete relief, which has continued to the present date, or about 1 year.

SUMMARY

A case of neuralgia of the lingual nerve or of a chronic streptococcal glossitis, is described. This was temporarily relieved by injection of alcohol into the lingual nerve.

SECTION IV

SUPPORTING THE FAILING HEART IN MAJOR SURGERY

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Circulatory Failure an Important Issue.—Among the graver complications with which the surgeon has to deal during or following operation, that of circulatory failure occurring either as a primary complication or as a part of a secondary complication stands as the most important issue to be met. For what serious medical or surgical complication do we see in which the prognosis does not depend ultimately upon the condition of the circulation? When, therefore, it occurs as a primary complication, it is an indication of conditions in which prompt treatment means everything. Occurring, as we know it does, in late secondary complications, it is largely an indication of the necessity of early support of the circulation.

Etiological Classification Adopted.—For the sake of clarity, the forms of cardiac and circulatory failure as we have seen them in our major surgical work are divided according to their etiology, although in many cases we have to deal with circulatory failure resulting from a combination of two or more etiological factors.

1. *Sudden Failure During Operation; No Cardiac or Arterial Disease.*—Sudden circulatory failure occurring during an operation in a person without cardiac or arterial disease is considered to be due to severe nervous insult resulting from undue manipulation of viscera in the presence of insufficient nerve block in anaesthesia. In such a case known to have no cardiac pathology, when anaesthesia has not been deep, when the blood in the field of operation suddenly becomes dark, when respiration as suddenly ceases, and when the hand against the diaphragm does not feel the pulsation of the heart, such a phenomenon has probably occurred. One such case responded immediately to the injection of 30 minims of adrenalin into the heart, which assumed its normal rhythm, and under a pulse of good volume the operation was completed, to be followed by an uneventful convalescence.

It is probable that combined local and splanchnic or a high spinal anaesthesia offers the best means of nerve block obtainable, with consequent lessened probability of a grave occurrence such as sudden failure of the heart.

2. *Progressive Failure During or After Operation; Cardiac Pathology.*—Progressive circulatory failure during or after operation occurring in a patient

with cardiac pathology, offers a problem in the chronic surgical cases that should have been settled prior to operation; but occurring in an emergency operative case, it is a problem requiring excellent judgment on the part of the surgeon as to whether further surgical procedure should be abandoned, or whether it should be continued in the hope of maintaining the circulation with stimulation until the operation is completed. Every such case is a separate and distinct one as regards the management. If a general anaesthetic is being given, very little added injury will be done if this is stopped and the operation completed while anaesthesia is still present. It is at times advisable to obtain haemostasis, establish drainage if necessary, and close the abdomen immediately. Certainly only the most urgent procedure should be completed. Subsequent work may be done after proper preparation of the patient and under the properly chosen anaesthetic.

As regards immediate treatment, it has been our observation that the patient with cardiac pathology, unless it is advanced myocardial, responds better to digitalis than does the patient with an equally fast heart who has no cardiac lesion. Digitalis therefore should be given; preferably, at first intravenously or subcutaneously. Digitalization can be accomplished rapidly by the rectal administration of the fluid extract in an immediate post-operative case, to whom we cannot, for a short time, give the drug orally. It is our practice to give 6 minims diluted in 2 ounces of distilled water; this is practically the equivalent of 1 dram of the tincture. Absorption is good, and the dose may be repeated at 3-hour intervals.

If circulatory failure is imminent, adrenalin should be given intravenously or subcutaneously. We administer 10 minims, and repeat in 15 to 30 minutes as needed. I have never seen a failing pathological heart improved by strychnine, a drug so frequently used. The added nervous irritability caused by it is objectionable; if the patient is not quiet, I on the contrary use morphine. In no case of this form should any solution such as saline or glucose be given unless there is the added complication of severe haemorrhage.

Finally, any patient who presents cardiac or arterial disease, and who is seen early enough, should have the benefit of digitalization prior to operation; and the question of the form of anaesthesia should be carefully weighed. Except in the presence of low blood-pressure, spinal anaesthesia whenever possible will probably be the procedure of choice. In the presence of low blood-pressure, local blocking, combined if necessary with blocking of the splanchnic nerves with novocaine, offers the least risk.

3. *Insufficient Circulation Caused by Haemorrhage.*—Circulatory insufficiency resulting from haemorrhage is an urgent indication for prompt treatment. The failing condition is due to lack of sufficient quantity of circulating blood to carry off the tissue wastes and return oxygen to the tissues, with the production of a temporary acidosed condition. Transfusion of blood is urgently indicated. During the preparation for transfusion, the need for a larger circulating medium

may be met with temporary improvement by the administration of physiological saline, Ringer's solution, or glucose solution intravenously, which adds to the fluid content of the blood and facilitates the exchange of gases in the tissues.

In blood transfusion the testing of compatibility may be quickly done by sending to the laboratory a blood clot from the abdomen or operative field from which the patient's serum may be extracted. It is then only necessary to test the serum for agglutination of the red-blood cells of a possible donor. Five hundred cc. of blood should suffice to relieve the symptoms of severe haemorrhage.

If perfect haemostasis has been obtained, adrenalin may be given immediately following haemorrhage, with very good temporary improvement through the arterial effect of the drug. Intravenous digitalis is not indicated in the absence of cardiac disease.

All of the above measures should be carried out without moving the patient.

In ruptured ectopic gestation, where haemorrhage has been severe, a prompt improvement in pulse is obtained by filling up the abdominal cavity with warm physiological saline solution. In some cases two or more liters may be poured in and the abdomen closed. The rapidity of absorption will be noted by the fact that after you have filled the abdomen and begun to close the wound, you will often find that just before taking the last stitch in the peritoneum you will be able to add an extra pint or more of the solution. The improvement in the pulse is as rapid as that noted following intravenous administration of saline. This procedure is of course applicable only to the absolutely clean cases; haemorrhage occurring in an inflammatory case could not be treated in this manner, because of the danger of spreading the infection.

4. *Failure of Circulation in Surgical Shock.*—Circulatory failure as seen in surgical shock is more satisfactorily prevented than treated. Perfect anaesthesia, whether local, spinal, or general, with as little manipulation of the tissues as possible, and the completion of the operative procedure as quickly as it can be thoroughly done, are the most important factors in the prevention of shock.

Upon the advent of the first signs of shock it is our practice to administer $\frac{3}{4}$ of a grain of ephedrine sulphate hypodermically. This has proved our most important drug in the elevation and maintenance of blood pressure in surgical shock, and the dose may be repeated at 3- or 4- hour intervals. Morphine given before operation and repeated before the patient reacts from the anaesthetic, will do much to prevent shock. It is our practice to keep a major abdominal case sleeping for 18 hours following operation.

The administration of a hypertonic glucose solution intravenously not only has proved beneficial in our service in the treatment of the circulatory failure of shock; but also is of inestimable value in certain types of cases when given immediately following operation, and at times prior to operation, for the prevention of shock. It is administered for the latter purpose in all cases of cholecystectomy in this Hospital, and it seems that excellent results are obtained from its use in cases involving the upper abdomen where there is probability of the existence of

temporary derangement of liver function. We administer by slow-gravity method about 700 cc. of a 10% solution. This not only adds to the blood volume but furnishes nourishment in the form of a readily oxidizable carbohydrate. Such a solution represents 37.5 calories per 100 cc. and, as we give it, about 250 calories at each injection,—the equivalent, in food, of 12 ounces of milk. This may be repeated 3 or 4 times daily if the condition present and the results obtained justify doing so. There is a much mooted question among surgeons, which the internist has never settled for us, regarding the administration of insulin with the glucose solution. We do not feel that a case of uncomplicated surgical shock requires insulin to care for the glucose given, and we therefore use insulin with glucose only when the latter is being given as a form of nourishment, and then only in those cases with severe starvation acidosis. We have never seen sugar in the urine following intravenous administration of glucose in pure surgical shock.

Early alkalization in shock seems beneficial, and it probably aids in the prevention of the acidosis seen in the late stage. Alkalization can be rapidly accomplished by the rectal administration of sodium bicarbonate. One rectal instillation of 4 drams dissolved in 4 ounces of distilled water will usually render the urine alkaline in 2 hours. If this should be expelled, 2 drams dissolved in 3 ounces will probably be retained and can be repeated at 2-hour intervals.

Repeated gastric lavage with warm solution of sodium bicarbonate will prevent any additional cardiac embarrassment incidental to gaseous distention of the stomach.

In addition to the above measures, the maintenance of body heat should be attempted by the use of hot-water bags.

5. *Failure of Circulation Caused by Poisons.*—Circulatory failure resulting from toxic absorption usually seen in the peritonitis of late ileus, and in the ileus accompanying late peritonitis, is the field of our most futile endeavors. It is the end rather than the beginning of our efforts. However, we employ in this service intravenous administration of physiological saline in large quantities for its diuretic effect, hoping to dilute and wash out some of the toxic material absorbed. Some improvement is at times noted, but it is usually only temporary, and in many cases treatment is of no avail.

In a few instances we have performed enterostomy in generalized ileus where distention was great, by opening the abdomen and grasping the first distended coil of intestine to present itself, incising it and suturing in a tube for the drainage of intestinal contents. Considering the heavy mortality attending the condition *per se* for which such a procedure is performed, we were not disappointed with the results obtained; and in our opinion this, or some similar procedure for draining the intestinal canal of its toxic contents, if perfected, undoubtedly will offer some future hope of relief in these cases. We do not believe it of use in the toxic cases primarily peritonitic.

6. *Failure of Circulation from Dehydration and Starvation Acidosis.*—Circula-

tory failure accompanying the acidosis of dehydration and starvation, usually seen in those surgical cases in which vomiting has been a constant feature, either prior to or following operation, is generally amenable to treatment if promptly administered. Here intravenous administration of glucose in 10% solution given very slowly not only will restore the fluid contents of the blood and tissues, but will give much needed nourishment. This condition is the indication *par excellence* for the use of glucose intravenously. If the heart is very weak, adrenalin should be given into the vein immediately before the glucose. Here I consider the question of insulin an important one, but again I do not believe that its use is indicated except where mental stupor is marked and the body functions are low. The glucose given in amounts of 700 cc., 3 times daily, will supply sufficient nourishment and also restore and maintain body fluids.

As soon as the circulation has responded to the intravenous solution, thorough alkalinization should be accomplished through the administration of sodium bicarbonate by rectum,—2 drams dissolved in 3 ounces of water every 2 hours until the urine becomes alkaline, and 3 times daily thereafter.

The treatment described above applies to all cases in which vomiting has been severe, but it is especially indicated in the cases of vomiting so often seen following cholecystectomy, because here liver function is impaired and readily oxidizable carbohydrates are needed. In some cases we give glucose prior to operation and repeat it before the patient has reacted from the anaesthetic.

In all gall-bladder and gastrointestinal cases we believe alkalinization of the patient as a routine preoperative preparation, when time allows, is of benefit. One dose of 4 drams, by mouth, of sodium bicarbonate is well borne and will usually render the urine alkaline within 2 hours. We do not find it objectionable to give it by mouth 4 hours before operation, and if this cannot be done we administer it by rectum immediately before taking the patient to the operating room. In our experience the so-called alkaline diuretics in the usual doses given do not render the urine alkaline early enough; and in some cases alkalinization has not occurred until after 8 days of administration, although the same patient could have been alkalinized on the 2nd day if given 1 dram of sodium bicarbonate by mouth 3 times daily. We therefore feel that this drug is a more efficient means of alkalinization than others in general use.

CUSTOMARY REMOVAL OF THE APPENDIX IN RIGHT INGUINAL
HERNIORRHAPHYREPORT OF NINETY-SIX APPENDECTOMIES IN ONE HUNDRED
CONSECUTIVE OPERATIONS FOR HERNIA

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Hernia in Relation to the Appendix.—The correlation of diseased or abnormal conditions of the appendix with hernia has been reported by a large number of investigators. Of these, the greater number have been concerned with the finding of acute appendicular pathology as a complication of hernia. The earliest record of the presence of the appendix in a hernial sac is cited by Deaver¹ as having been reported by Claudious Amyard, Esq., who, in 1735, in the course of an operation upon a boy of eleven, traced a sinus in the thigh to an incarcerated scrotal hernia, wherein was found the appendix, perforated by a pin. Morgagni² describes finding the appendix in the hernial sac, in the performance of dissection (Ewart³).

Incidence.—The incidence of association of the appendix with the hernial sac has been variously estimated by more recent analyses.

Wood⁴ reported the presence of the appendix in 58 of 3,054 hernias of all types, irrespective of the presence of other viscera. Inguinal hernias were found to harbor the appendix more frequently than those of the femoral site.

Robinson,⁵ in a series of autopsies, found that in approximately one-third of 435 instances the caecum (and appendix) were in "potential position" to enter the dependent peritoneum of inguinal hernias.

Coley⁶ encountered the appendix in the sac of less than 5% of inguinal hernias subjected to operation; while Kelly⁷ expressed the belief that the appendix was a component of 2% of all hernias, irrespective of variety and location.

Kelly and Hurdon collected, in 1909, 200 cases in which the appendix appeared in the situations under discussion, the finding of 75% being identified with inguinal rupture.

Rivet⁸ reported 63% inguinal and 30% femoral in 94 cases of appendicular hernia.

Etiology.—These writers ascribe to Rokitansky, Virchow and Orth the congenital theory of appendical implication: that anomalous development, investiture or inflammation of the fetal peritoneum, is the cause alike of hernial protrusions and appendical participation. Carnett,⁹ in an independent investigation, confirmed this theory, which had been ascribed by Jopson¹⁰ to Wrisberg and Lockwood. Hutchison¹¹ was of the opinion that disease of the appendix

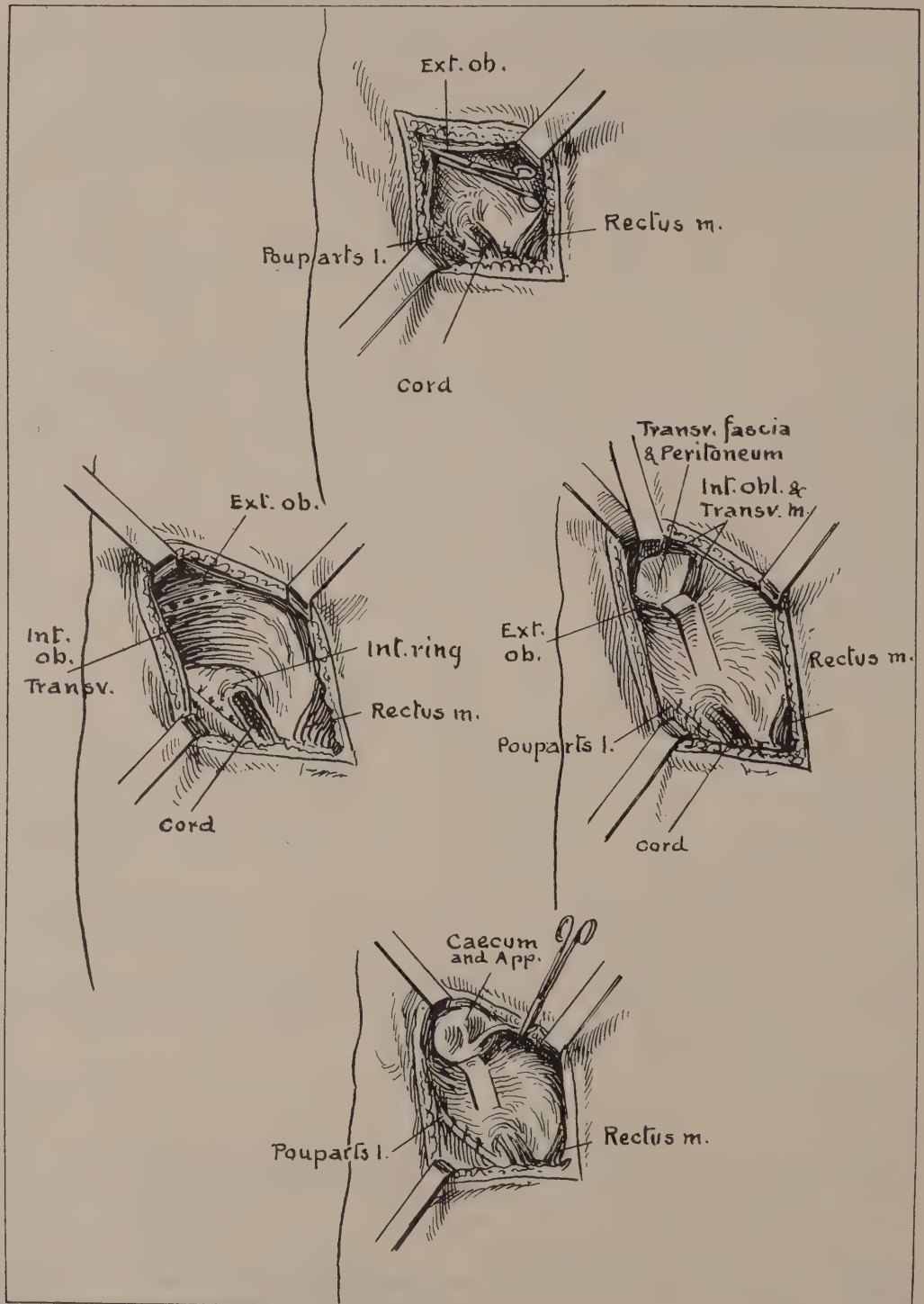


FIG. 1

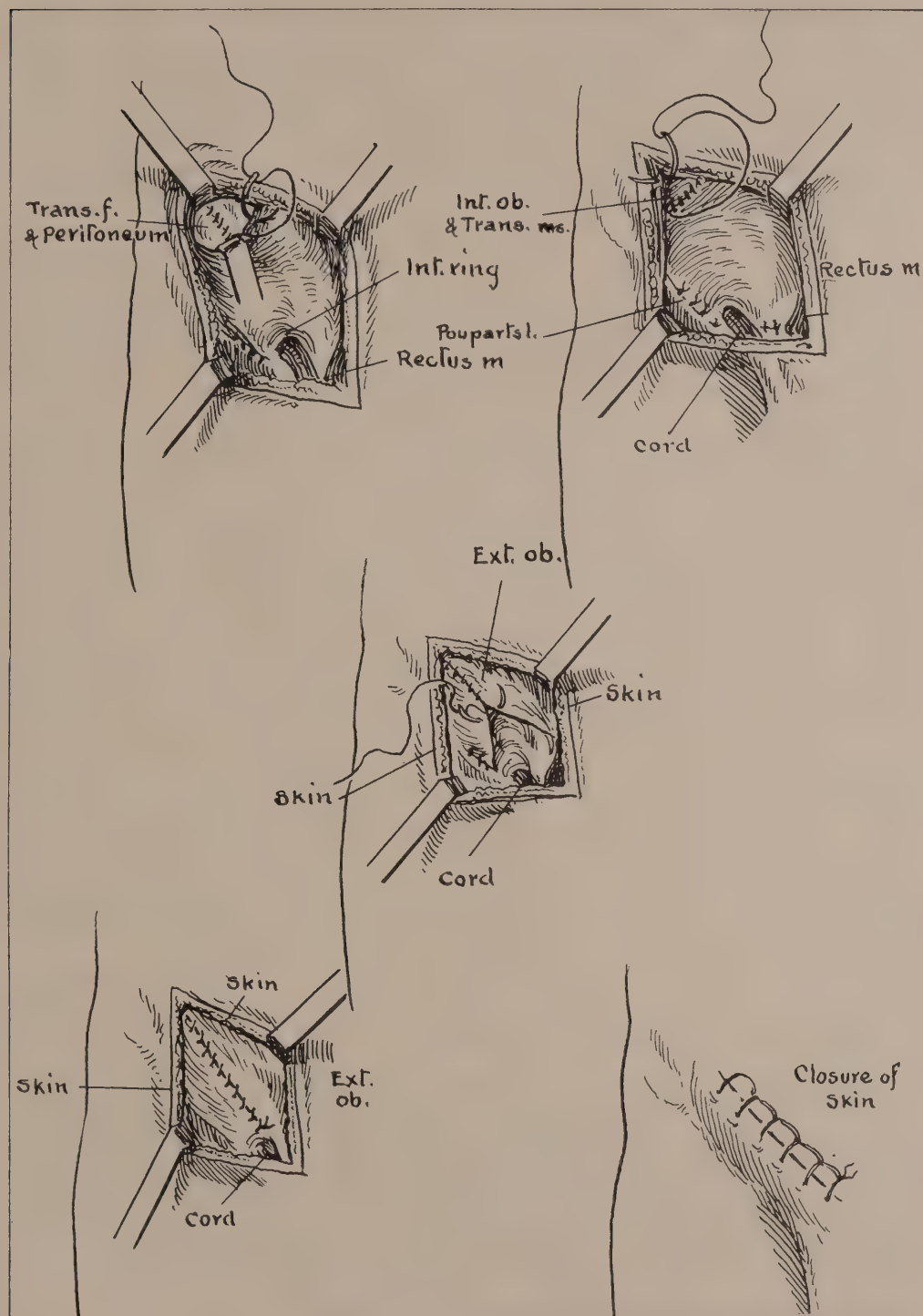


FIG. 2

might be the exciting cause of hernia—a theory which has attracted little support and no further exemplification. He detailed the occurrence of acute appendicitis following herniotomy, as did Alexander.¹² Unquestionably, abdominal rigidity or distension associated with peritonitis of appendical origin may introduce viscera into a hitherto unoccupied hernial sac, and induce incarceration or even strangulation (Davis and Peon¹³). Other writers have been concerned with the existence of acute appendicular infection as a component of hernia.*

Purpose of Investigation.—Two considerations prompted the present operative inquiry. They were, (a) determination of the incidence and extent of appendical pathology in right inguinal hernia, and (b) the practicability of routine removal of the appendix through the usual herniotomy incision. With these objectives, 100 consecutive right inguinal hernias were operated upon in Hospital Santo Tomas, Panama, through the courtesy of the Chief of Surgical Staff, Dr. A. S. Boyd; and these included 28 bilateral, 11 irreducible, and 3 strangulated hernias.

Of the 100 cases, 96 were subjected to appendectomy through a hernia incision of ordinary size; and, of these, 51 operations were completed by ingress through the sac, and 45 by a supplementary opening of the peritoneum, which will later be described under "Technique." Of the 4 cases in which appendectomy was not done, one was of strangulation and 3 of abnormally high caecum. The completed cases comprised 8 in which delivery of the appendix was difficult; and of these, 4 demanded a degree of technical application which overshadowed the possible benefit to be conferred. In one instance it was necessary to leave *in situ* 1.5 cm. of the tip of a retrocaecally situated appendix, with sequelae of pain and fever. There were 8 post-operative infections; 6 of class A, and 2 of class B. No other local complications were encountered. Stovaine (Billon) was employed intraspinally in 93 cases; ether was used 5 times; and novocaine locally twice. Three patients suffered post-operative bronchopneumonia.

Two deaths marred the clinical aspect of the series. One was due to the late effects of secondary haemorrhage from a needle wound of the left deep epigastric vein, accidentally incurred during a simultaneous left inguinal herniorrhaphy; and the second resulted from unsuspected chronic ulcerative colitis.

Pathology.—Doubts concerning the value of this sometimes difficult procedure were definitely dispelled by the pathological findings. No less than 11 instances of sliding hernia of the caecum, appendix, or both, were encountered. This relatively high percentage can be understood if one bears in mind the large size of hernias in communities where surgical correction is for many years postponed or habitually avoided. The appendix was found free in the sac contents in 6 cases; and in 1 of these cases (that of strangulation) it was acutely inflamed. Grossly diseased appendices (including the adherent) were removed on 11 occasions. Development anomalies totaled 26; and of these, 9 presented adhesions or membranes of development type, 8 were of abnormally high caecum or appendix, 5

* See "Supplement to Bibliography" at the end of this paper.

were retrocaecal in situation, and 4 were of redundant caecum; 2 appendices harbored *Endamaebae histolyticae*; and 1, an encysted cherry seed. With the inclusion of 3 cases in which the caecum was too high to be presented in the operative zone, these abnormalities totaled 60.

From a pathological viewpoint, it is seen that the conditions justified performing the appendectomies in addition to the herniorrhaphies, in spite of the additional difficulties involved. The only analogous investigation on record—that of Sheldon¹⁴—yielded 8 diseased appendices out of 12 removed, a pathological percentage almost identical with that of the present series.

Technique.—The manoeuver employed to gain access to an appendix not readily delivered in the sacular peritoneum was used and described by F. Torek.¹⁵ This consists, in effect, of a supplementary muscle-splitting approach to the peritoneum in the upper angle of the hernia incision. It was Torek's practice, however, to extend the skin incision upward, and to remove the appendix before performing reconstruction in the inguinal canal. Harrigan¹⁶ made use of this technique, as did Coley.¹⁷ The latter effected appendectomy before attacking the hernia. These surgeons have not attempted the routine removal of the appendix in such cases, nor estimated the frequency of appendicular involvement. The present writer has found it unnecessary to enlarge the skin aperture, the normal looseness of the tegument in the iliac region permitting adequate retraction. A desire to minimize the risk of infection dictated complete suturing of the conjoined tendon and arching fibers of the internal oblique and transversalis muscles to Poupart's ligament, before appendectomy was performed. Simplification of the technique and acceleration of closure have been obtained by the use of a single strand of No. 1 iodine catgut for peritoneum, transversalis fascia, the muscles, and external oblique aponeurosis, the suture being locked at the completion of each step.

Although periodic examination of the patients in this series was impracticable, it was well established that most recurrent hernias were accustomed to return to the Hospital, for the reason that no other medical service was available. There were no recurrences known to the operator one year after completion of the series.

CONCLUSIONS

1. Abnormalities of the appendix, justifying its removal, are present in the majority of individuals with right inguinal hernia.
2. The appendix can be safely removed through the usual herniotomy incision, in a high percentage of cases. Since the addition of this step does not add appreciably to the operative risk, nor jeopardize the effectiveness of hernia repair, routine appendectomy is considered desirable.

NOTE:—This paper was originally published in the *Annals of Surgery*.

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APPENDIX MUCOCELE PRODUCING AN INTESTINAL OBSTRUCTION—CASE REPORT

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Pathology of the Condition.—Before giving the clinical history and operative findings on a case of mucocele of the appendix, that caused intestinal obstruction, I will discuss briefly the pathology of this condition. The formation of a mucocele occurs where the lumen of the appendix is obliterated at a certain point by a chronic inflammatory process, and naturally the secretions that form in the open lumen beyond the constriction accumulate, as there is no avenue of escape and the distal part of the appendix becomes cystically dilated, appearing as a thin-walled sac filled with watery mucus.

This condition is not sufficiently rare in itself to merit a report, but the complication of an intestinal obstruction directly dependent on its presence is certainly uncommon. Therefore the following report is submitted.

CASE REPORT

Case No. 1,536

History.—L. C., Porto Rican, white, female, 55 years of age, was admitted to this Hospital with a history of intense abdominal pain lasting for 4 days, espe-

cially marked in the right lower quadrant, and characterized by sharp exacerbations accompanied by nausea and vomiting. Temperature, 100.8° , respirations, 32, pulse 102. A similar attack had occurred 12 years before, and was diagnosed and treated medically by another physician as acute appendicitis. She recovered from that attack, but had always been subject to gastrointestinal disturbances. She never had children, and had never complained of pelvic troubles. Other history negative.

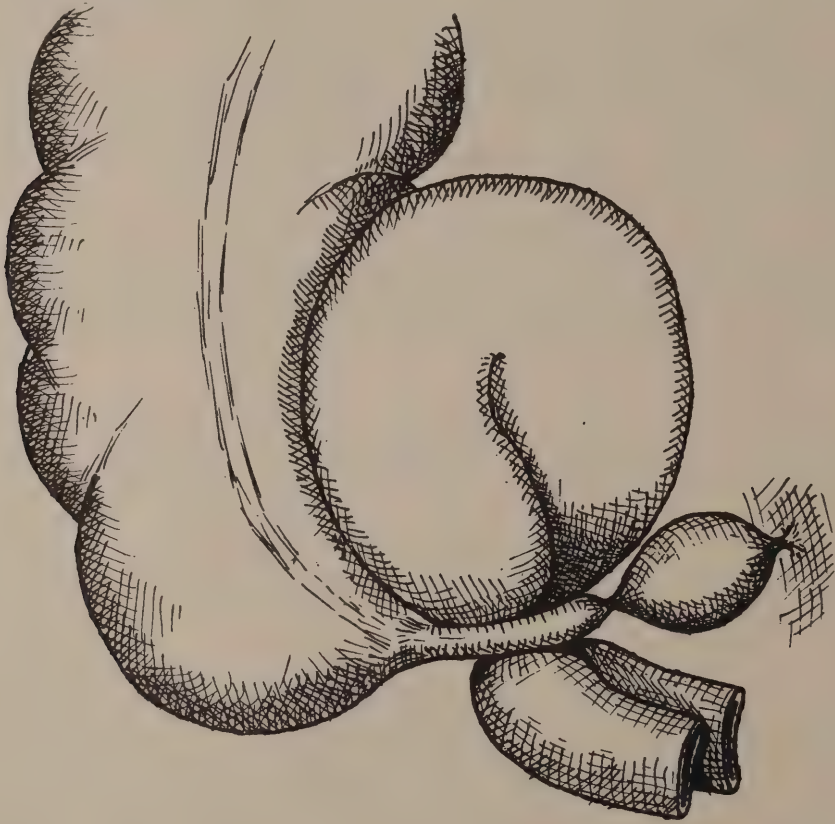


FIG. 1. SKETCH OF CAECUM, APPENDIX, MUCOCELE ATTACHED TO MESENTERY, AND INCARCERATED LOOP OF INTESTINE

Physical Examination.—Well developed, obese, adult female, about 55 years of age; teeth in poor condition, slight pyorrhoea; nose, throat, lungs and heart negative. Abdomen showed slight distension, with tenderness on pressure over the whole area, especially marked over the appendicial section, where a definite mass was felt.

Laboratory Findings.—Leukocyte count, 17,600; blood smear for malaria, negative. Urine: reaction, acid; specific gravity 1.020; albumin +, sugar, negative; cast, hyaline +; pus ++. Blood: haemoglobin; bacteria, negative. Meinicke reaction for syphilis, negative.



FIG. 2

Diagnosis.—With the above history, the physical findings and the leukocytosis, the diagnosis of acute appendicitis with probable appendicial abscess was made, and the case was brought to the operating table.

Operative Findings.—Spinal anesthesia, novocaine .12 gr., was given and a right rectal incision was made. As soon as the peritoneum was opened, immediately over the tumor a loop of purplish, lusterless, distended intestine appeared. After isolating the caecal area with packs, we found that the proximal end of the appendix showed no gross inflammatory signs, a fact in vivid contrast with the congestion in the loop of the ileum, already mentioned. When we tried to deliver the appendix we encountered adhesions and found cystic dilatation of its terminal end, which was densely adherent, by a thick fibrous band, to the mesentery. Under the bridge thus formed a loop of intestine had been incarcerated, producing an intestinal obstruction with symptoms that closely resembled an attack of acute appendicitis. (See Sketch, Fig. 1, page 210.) The fibrous band was cut, the loop of intestine released, and an appendectomy performed. While the abdomen was being closed, the patient had a large bowel movement. Her convalescence was uneventful, and she was discharged on the 11th day. Following is the pathological report of Dr. F. B. Mallory, with his interesting comments and a photograph (see page 211) which he has very kindly sent to us:

Microscopic examination.—Proximal end of appendix practically normal. The terminal half was dilated into a cyst containing mucus and calcified material. The mucosa had disappeared. In the submucosa were numerous small masses of lime salts. *Diagnosis:* Mucocoele. The mucus resulting from secretion by the beaker cells sometimes occurs in stringy masses, as here, but occasionally in rounded balls like fish roe. I am sending you a photograph (Fig. 2) of the best case I have ever seen. It shows the appearance after section of the mucocoele and escape of the balls of mucus.

This report of Dr. Mallory's confirms our post-operative view that the symptoms were not due to an acute inflammatory process of the vermiform appendix, but were the result of an intestinal obstruction.

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CHRONIC BILATERAL HYDROSALPINX—CASE REPORT

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A Case of Special Interest.—From the standpoint of the gynecologist, anomalous conditions of the female pelvic viscera resulting from various inflammatory processes offer little that is new or unusual.

The following case, however, of chronic bilateral hydrosalpinx, or cystic tubes, deserves a little more than passing mention, and is presented because of the unusually perfect pathological conformation which could well be used as a model for a textbook description.

CASE REPORT

History.—E. H., female, Colombian, housewife, aged 26 years, on admission to the Santa Marta Hospital had complained of painful disturbances in her lower abdomen for the past 3 years, and associated with irregular, painful, and excessive menstruation with leukorrhoea. Recently the pain had been more severe and associated with abdominal distension. All of her symptoms, in other words, had become exaggerated, and she was brought to the Hospital for treatment.

Examination and Treatment.—The usual bimanual examination revealed large, tender tumor masses in the pelvis. She submitted to operation, which was performed the day following her examination. The accompanying illustration (see page 214) shows better than any explanation alone could describe, the findings at operation—hydrosalpinx of both Fallopian tubes, of unusual proportions. There was little difficulty in isolating and removing the mass. She made an unusually good recovery.



DOUBLE HYDROSALPINK (ACTUAL SIZE)

CONGENITAL HAEMATOMETRA

(WITH CASE REPORT)

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Etiological Classification of Haematometra.—Bernutz, in 1848, reviewed from the literature a number of cases of haematometra and proposed a classification, on an etiological basis, into 4 groups: (1) congenital, (2) following labor, (3) a reflex type comparable to cystitis with retention, and (4) retention resulting from emotional states such as shock and anger.

Classification of the Present Case.—Simon¹ has recently reviewed the literature on the subject of haematometra and has added to those reported twenty three cases from the Mayo Clinic. The case which I report must fall in Group 1, as mentioned above, and I quote the etiology as given by Simon:

Embryologically, according to Piersol, the uterus develops from the Müllerian ducts which unite at about the eighth week of intrauterine life. After the union of these ducts, the intervening septum disappears and a single tube is formed, the anlage of the uterus. This ends blindly and is joined to the urogenital sinus by a solid cylinder of cells. This lumenless segment of the fused Müllerian ducts represents the anlage of the vagina. By the end of the fourth month of intrauterine life, it too has normally acquired a lumen and the anlage of the cervix has made its appearance at the uterovaginal juncture.

Special Comment.—The chief anomalous conditions of the uterus and vagina depend on defective or incomplete development or imperfect fusion of the two Müllerian ducts. Arrested development of the lower part of these fetal canals accounts for the absence of all or any part of the cervix or vagina or the persistence of a membrane obstructing their lumen at any point. Obliteration (or duplication) of different portions of the genital tract may occur in numerous combinations.

Unusual Features of the Present Case.—The case coming to our attention was unusual, first, inasmuch as the condition must have existed over a long period of years—although the patient had noted the presence of the tumor for only a comparatively short period—and secondly, because of the fact that the usual developmental anomalies were not associated with the absence of the cervical canal.

CASE REPORT

F. M., Case No. 25,238.—An Indian woman, aged 38 years, native of Honduras, was admitted to the Hospital complaining of a tumor in the abdomen and pain

1. "Hematometra," Harold E. Simon, M.D., *Surg., Gynecol. and Obstet.*, Vol. XLVII, No. 3, Sept. 1928, p. 356

in the gall-bladder region. She stated that she had first noticed the tumor 4 years previously. The history was obviously unsatisfactory and unreliable, as the patient spoke neither Spanish nor English and seemed mentally obtuse.

Physical Examination.—A fairly well developed Indian woman of small stature; the tongue clean; the feet and legs slightly oedematous; several teeth missing, and some badly decayed. The abdomen was greatly enlarged, obliterating the umbilicus, and tympanitic along the costal margin. A large multilobed movable non-tender tumor filled the abdominal cavity from the floor of the pelvis to the costal margin. The external genitals showed some under-development, but there was a patulous virgin introitus. A small movable cervix could be palpated through the rectum. Blood pressure, systolic 136, diastolic 86. Heart and lungs, negative.

Laboratory Examination.—Blood negative for malaria or any marked dyscrasia. Urine negative. The stool contained uncinaria, ascaris and trichocephalus ova.

A preoperative diagnosis of uterine fibroids was made, and the patient was submitted to operation, but died suddenly at the completion of the primary incision.

Post-mortem Examination.—Examination of the abdominal cavity showed a dark-red multilobulated tumor springing from and including the uterus. It was pressing hard against the liver in the gall-bladder region, but there were no adhesions from the tumor to surrounding structures, the surface being smooth and glistening. The tubes were patent to the points of uterine attachment. The ovaries were small but apparently normal. The tumor, weighing $11\frac{3}{4}$ kilos, with cervix attached was removed. Externally the cervix was elongated, smooth and rounded, but there was no dimpling nor other sign of the external os. The mass of the tumor was incised through the thickened wall, which had the consistency and appearance of the muscle of a pregnant uterus. The cavity was filled with a tarry, unorganized semifluid mass. It was found that each of the lobules, all being pedunculated to a greater or lesser extent, was hollow and had connection with the main cavity. At the proper location for the internal os there was a small shallow dimple, but it was impossible to demonstrate a cervical canal with a probe. No opening from the cavity to the tubes could be found.

Microscopic Examination.—Sections were removed for microscopic examination and sent to the pathologist,¹ whose report was as follows:

UFS 170 F. M. Case No. 25,238.—Microscopic examination showed a tumor consisting of smooth muscle fibres, in most places widely separated by fluid. The connective tissue stroma was abundant. *Microscopic diagnosis:* Oedematous liomyoma, benign.

SUMMARY

- (1) A case is reported of a large haematometra in a woman 38 years of age.
- (2) There was non-existence of a cervical canal.
- (3) There were no signs of a previously existing inflammatory process in or about the cervix.

1. F. B. Mallory, M.D., Boston City Hospital, Boston, Mass.

CONCLUSION

That the above existing condition was due to an unusual congenital absence of the cervical canal, unassociated with the more common developmental defects.

ECTOPIC TESTIS AS A CAUSE OF TORSION OF THE SPERMATIC CORD

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PRELIMINARY REMARKS

Different opinions are current as to the cause of torsion of the spermatic cord, and consequently the following question arises: Is ectopic testis a primary cause of torsion?

The testis in its normal descent passes through three zones: abdominal, iliac, and inguinal. If for any reason descent is arrested, the testis will be found in one of these sites. The attachment of the gubernaculum testis is considered the dominant factor in promoting normal descent. Congenital absence or loose attachment of the gubernaculum testis may result in incomplete descent of the testis or predispose to volvulus. When complete scrotal migration of the testis has occurred, the presence of an unduly long gubernaculum testis may be diagnosed only when volvulus or torsion of the cord supervenes. This unusual abnormality may be termed scrotal ectopia. The actual onset of torsion of the cord may be produced by traumatism, tumors of the testis, strain, or a spontaneous contraction of the cremaster muscle.

I am able to record two cases of torsion of the spermatic cord, and an additional illustrative case, with the object of emphasizing the importance of early operative intervention.

CASE REPORTS

Case 1.—A. B., merchant, aged 19, native, single.

History.—Severe pain in the right inguinal region, of one year's duration, made worse by standing, walking and sitting. The only position in which the patient was entirely free from pain was the dorsal decubitus. There was no known cause of onset. Fifteen days before observation the patient suffered a severe exacerbation of pain, accompanied by nausea and vertigo. On the following day he observed that his right testicle was no longer in the scrotum and that a tumor had appeared in the right groin

Physical Examination.—An extremely sensitive tumor was found in the right

inguinal region at the site of the external ring. It was hard, oval, and about the size of a pigeon's egg. The right side of the scrotum was oedematous and without its normal content. No impulse could be felt in the tumor when the patient coughed or strained. Intestinal function was normal.

Diagnosis.—Atrophy of testis secondary to torsion of its cord.

Operative Findings.—Operation disclosed the testicle in an inverted position at the external inguinal ring, suspended by a twisted and congested spermatic cord. The torsion of the cord was corrected and the testicle secured by suture to the scrotal fundus. The gland was considerably smaller than its fellow.

Further History.—Twenty days after operation the patient was discharged in good condition, with the testicle in normal position and increased in size.

Case 2.—P. de la R., aged 22, native.

History.—The day before admission to the Hospital, the patient experienced severe pain in the left thigh and groin while lifting a cross-tie. Coincidentally the left testicle ascended to the groin. For many years a right scrotal hernia had been present. There had been several previous attacks similar to the present one.

Physical Examination.—The right side of the scrotum was found to contain a large hernia; in the left side the testis was found at the external ring (congested and small).

Diagnosis.—Torsion of the cord.

Operative Procedure.—The left testicle was exposed, its cord untwisted, and its body anchored to the lower part of the scrotum. A right inguinal herniotomy was done under stovaine anesthesia.

Further History.—The patient was discharged from the Hospital in 19 days with the testicle in good position.

Case 3.—F. O., aged 20, native.

History.—Abrupt swelling of the right testicle began 5 days before observation, practically unattended by pain. Five years previously there had been a seizure of similar character, which subsided spontaneously within a few days.

Physical Examination.—The right testicle was the size of a small orange,—hard, tense and rather tender. There was no urethral discharge. The cord was thickened and moderately sensitive.

Diagnosis.—Torsion of the cord.

Operative Findings.—The testicle was found to be 3 times normal size, of uniform consistency, without evidences of inflammatory changes. Tumor was suspected and orchidectomy was performed, with high removal of the cord. Recovery was uneventful.

Pathological Report (Dr. F. B. Mallory).—“A tumor containing epithelial and fibrous structures disseminated throughout the normal gland substance, and also occurring in solid masses. Mitotic figures, numerous. *Diagnosis:* Slowly growing embryoma.”

ANALYSIS OF CASES

Case 1.—The case demonstrates recurrent attacks of torsion, with no obvious exciting cause. It is of interest to observe that after 15 days' incarceration the testis regained normal size, after operation.

Case 2.—In this case it was evident that the testicle had never been securely fixed in the scrotum. Retrograde movement had been of frequent occurrence. Atrophy was apparently due to ectopia. It is interesting to reflect that gangrene had not occurred after 12 hours of torsion.

Case 3.—This case is included because of the preoperative diagnosis of torsion. It is possible that the attack of severe testicular pain experienced 5 years before was actually due to torsion. The cause and nature of the sudden enlargement of the testicle experienced 5 days before observation, remain undisclosed.

INTESTINAL OBSTRUCTION CAUSED BY *ASCARIS LUMBRICOIDES*
A CASE REPORT

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PRELIMINARY REMARKS

Among the many conditions that cause intestinal obstruction, impactions of lumbricoid worms are included.

Ordinarily, even with rather severe infestations by this parasite, *A. lumbricoides*, obstruction does not occur, probably because of the tendency of the worms to migrate, producing a more or less equal distribution throughout the intestinal canal. The exception, however, in heavily infested persons, does occur; especially after the administration of a vermifuge accompanied by a heavy purge, and the resulting increased peristalsis.

In the following case this was considered an important factor:

CASE REPORT

History.—R. L., male, Colombian, farm laborer, aged 24 years, was admitted to the medical wards complaining of fever and epigastric pain.

Laboratory Findings on Admission.—The laboratory findings on admission were as follows:

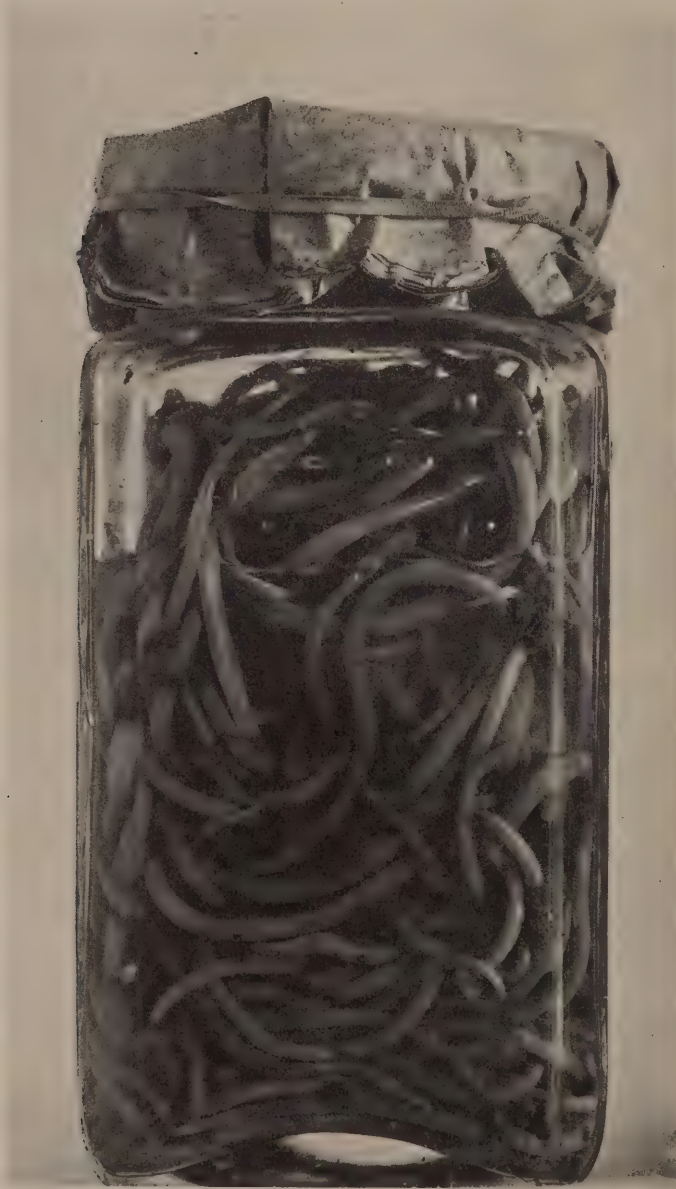
Stool: Ascaris + + +, Uncinaria + +, Trichocephalus +

Blood: Positive for E. A. malaria, Hgb. 75%

Wassermann: Negative, white-blood count 5,500

Urine: Negative

Treatment.—He was given a purge of calomel and salts on admission. On the following day he had 14 bowel movements, and 4 more that night. On the 3rd



SPECIMEN JAR CONTAINING SOME OF THE LUMBRICOID WORMS REMOVED AT OPERATION FOR INTES-
TINAL OBSTRUCTION CAUSED BY ASCARIS LUMBRICOIDES

day following admission his temperature rose to 103° , and treatment for malaria was started. At the same time he developed a severe pain over the right side

of the abdomen, accompanied by vomiting, and rigidity of right rectus muscle. A distinct mass in this area, which was quite tender, could be palpated.

An exploratory operation was at once performed through a right rectus incision. A large sausage-shaped tumor mass, about 12 inches or more in length, was encountered in the lower ileum.

Delivery through the abdominal incision was easily effected, and a longitudinal section of the excised foreign body revealed a dense, foul-smelling mass of deep-green faecal matter in which numerous round-worms were entangled, many of which were alive. Altogether, 330 were removed. The mass was so densely embedded in the bowel lumen that it interfered with the circulation of the blood and its removal was accomplished only with difficulty. The bowel was then sutured and drainage established. Immediately after the operation, and while still on the table, the patient vomited 7 worms, and during the next few days passed 100 more by rectum.

Results.—He made a very good recovery, however, and on discharge had gained considerably in weight and strength.

The accompanying illustration shows a specimen jar containing some of the worms removed at operation.

TRAUMATIC ANEURISM OF THE SCALP—CASE REPORT

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The following case of aneurism is reported because of its uncommonly rare location and occurrence. Traumatism was responsible in this instance.

CASE REPORT

History.—R. S., Colombian, male, aged 30 years, resident of Santa Marta, employed on the docks. His history revealed a severe injury to the back of the head received about a year and one-half ago, when he was struck by a heavy piece of timber while at work. He became unconscious, and remained incapacitated for work for many weeks. Later, however, all after-effects of the injury had apparently disappeared; then, 5 or 6 months ago, over the site of the old injury area, he noticed a swelling which became gradually larger but was not painful.

Examination.—He was admitted to the Hospital and examination revealed a tumor, about the size of a hen's egg, on the back of his head at about the left parieto-occipital junction. The swelling was painless to touch, pulsated, and on compression would disappear but immediately reform on the release of pres-

sure, confirming a diagnosis of aneurism. He appeared otherwise in good health, although his blood Wassermann was ++ and the Kahn test ++++.

Treatment.—At operation the tumor was approached from the side by means of an elliptical incision. The wound bled very freely, requiring more than the usual haemostatic measures. Dissection was completed and the flap thrown back, thus isolating the tumor, or aneurism. A connection between the outer and inner surfaces of the skull was discovered at the base of the tumor, where one could feel a depression in the skull about the size of a quarter-dollar. A



FIG. 1

hollow pedicle passed through the depression. This was ligated, and the tumor removed, which on section proved to be an aneurism that unquestionably had resulted from the injury to one of the branches of the middle or posterior meningeal arteries. Recovery was uneventful and complete.

Comments.—The accompanying photographs serve to illustrate the condition before the operation (Fig. 1), the condition after the operation (Fig. 2), and the aneurismal sac (Fig. 3). The latter was opened and freed of its contents after operation.



FIG. 2

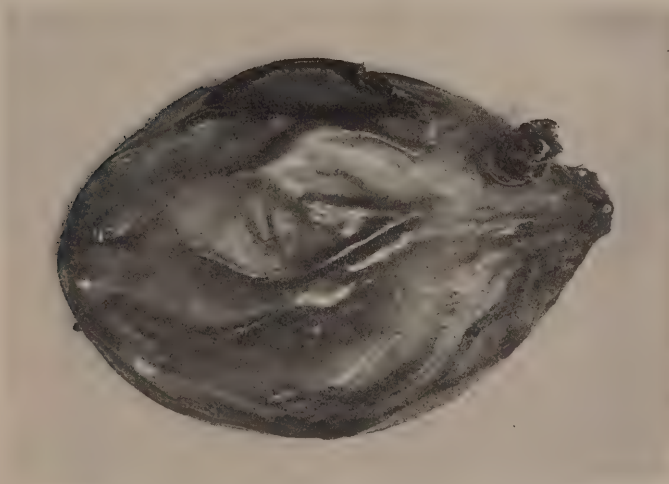


FIG. 3

CANCER OF THE KIDNEY IN A TWO-YEAR-OLD CHILD

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Tela, Honduras

History.—A Carib male child, aged 2 years, weight 24 pounds, was admitted to the Hospital May 21, 1928, with a large abdominal tumor. The father stated that this growth was of 1 year's duration, not painful, but that it had increased in size rapidly during the past 3 months, and that on 2 occasions the child had passed bloody urine.



FIG. 1

Examination.—The child was fairly well nourished and developed. Physical examination was negative with the exception of a large, slightly movable, solid tumor filling a considerable part of the abdomen. The *blood* was negative for malaria parasites; hb., 45%; leukocytes, 9,800; *stool*: hookworms, trichuris, ascaris ova, and flagellates; *urine*: acid; no sediment, sugar or albumin.

Treatment.—Laparotomy was performed on May 25, 1928, and a right rectus incision from the costal margin to the ileum was necessary to expose the tumor.



FIG. 2

The mass, which proved to be a tumor of the right kidney, was nodular and irregular, lying behind the ascending colon. The left kidney was about twice the normal size, but no pathological changes could be determined by palpation. There were no enlarged mesenteric glands. The other abdominal organs were apparently normal. The posterior peritoneum was opened, the mass freed, and nephrectomy performed with much less difficulty than was anticipated.

Temporary Discharge of the Patient.—Convalescence was uneventful and the

patient was discharged, apparently well, 18 days after the operation. Photograph 1 (page 224) was made on that date.

Report on the Tumor.—The specimen, which weighed 4 pounds (Photograph 2, page 225) was examined by Dr. H. C. Clark, who reported as follows:

Tumor right kidney, weight 4 lbs. This is an embryonal tumor of the renal blastoma which is well encapsulated but whose architecture is that of an adenocarcinoma. The kidney is spread out over the pole of the tumor and in the condition of a normal kidney. I should say that only about one-third of the kidney tissue had been destroyed by pressure atrophy. Metastases seldom occur with these fetal tumors, but there is the possibility that the other kidney may produce the same kind of tumor. Bilateral involvement has been recorded in several cases.

Readmission and Fatal Termination.—On November 6, 1928, the child was readmitted to the Hospital with a history of fever, cough and dyspnoea of one week's standing. The patient weighed 24 pounds, was emaciated, and there were palpable masses at the site of the right kidney pedicle and near the brim of the pelvis on the right side. The left chest was flat, and no respiratory sounds were audible. There were marked prostration and extreme dyspnoea. The temperature was 103°, and the pulse rapid and of poor quality. X-ray showed that the left chest was filled with fluid, and the heart and trachea displaced to the right. The child died on November 17, 1928.

Autopsy Findings.—At autopsy a tumor was found filling the whole left chest; also a mass at the right kidney pedicle, 2 inches in diameter; one of equal size at the brim of the pelvis; 1 nodule $\frac{1}{4}$ inch in diameter on the surface of the liver; and many metastases in the mesenteric glands.

The following report on the same specimen was made by Dr. Eugene R. Whitmore:

The specimen consists of two parts. (1) A mass marked, "Tissue 349, Tela Hospital, May 25, 1928. Fixed in formalin. J. A., aged 2 years, Carib negro child. Tumor in abdomen for 1 year. Bloody urine." (2) Three small pieces of tissue marked "364—in 80% alcohol. Fixed in Zenker's solution."

The mass is oval in shape, 7 inches by 4 inches; is pinkish gray in color, with a smooth surface. The mass has been cut open longitudinally, and the two halves have been folded back on the uncut portion of the capsule as a hinge. There is a definite, tense, fibrous capsule, and at the cut surface the tissue bulges and rolls outward over the cut capsule. On section, the mass is seen to be coarsely lobulated, without any definite fibrous bands separating the lobules. The cut surface is finely granular, except for a yellowish-gray ragged area in the center. At one pole of the mass is compressed kidney tissue, with a definite line of demarcation, and evident condensation of fibrous tissue, between the kidney tissue and the rest of the mass. As the kidney tissue extends down over the mass, it is thinned out and finally disappears in the fibrous capsule of the mass itself.

The small pieces of tissue are about the size of an almond, and gray in color.

Microscopically the kidney tissue shows normal glomeruli and tubules in the outer part of the thicker portion, which become compressed and distorted as we approach the other tissue of the mass. The glomeruli disappear and the tubules become reduced to a few cells lying among strands of connective tissue of con-

stantly increasing density, until we reach the dense fibrous tissue which separates the kidney tissue from the rest of the mass.

The great part of the mass shows an alveolar structure, with fibrous alveolar walls, and the alveoli filled by masses of fairly large cells, which in some places



FIG. 3

are broken down in the center of the alveolus (Fig. 3). In some areas these large cells are arranged along the wall of the alveolus, leaving a definite lumen in the center, like a cross section of a gland tubule (Fig. 4). By Brilmyer's method, these cells in the alveoli stain in the same way as do the epithelial cells of the kidney tubules.

The smaller pieces of tissue show the same alveolar structure as the mass just described: there are the same alveolar walls of connective tissue, with the alveoli

filled with rather large cells, which in some places arrange themselves along the wall of the alveolus, around a definite lumen. In some places the connective tissue of the alveolar walls is in the form of fairly dense fibrous tissue; in other

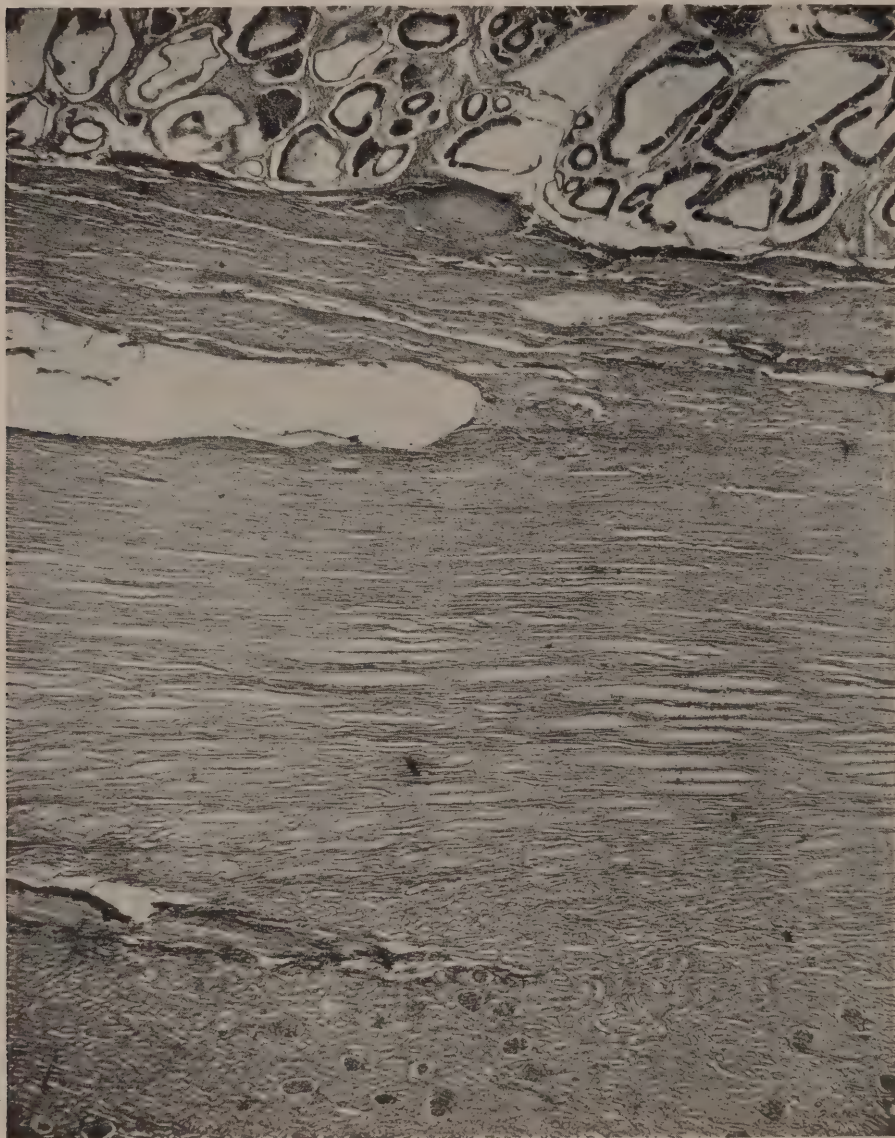


FIG. 4

places it is much looser, with rather numerous cells with large nuclei. There is no normal tissue to indicate whence these pieces of tissue came.

Diagnosis: The tumor is an adenocarcinoma of the kidney, of the embryonal type that occurs in infants, having the same origin as the epithelium of the renal tubules.

Not infrequently these tumors do not metastasize, even though they grow to a large size. However, it is rare for a child, if it survives the operation, to live as long as a year afterward.

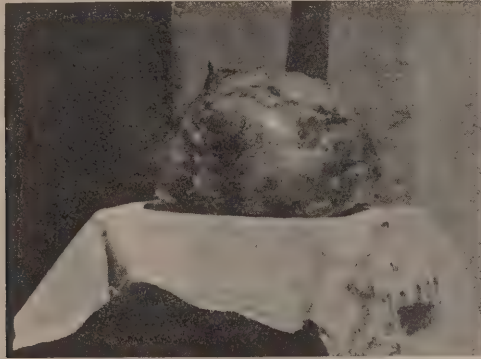
LARGE TUMOR OF OVARY IN TWELVE-YEAR-OLD CHILD

R. B. NUTTER, M.D.

Tela Railroad Company Hospital

Tela, Honduras

History.—A Honduranian girl, aged 12 years, was admitted to the Hospital with a tumor in the lower abdomen which had first been noticed 3 years before. She never had menstruated and did not complain of pain, nor was there tenderness over the tumor. Dyspnoea on exertion had been present for several years.



TUMOR WEIGHING APPROXIMATELY 9 POUNDS, REMOVED FROM THE RIGHT OVARY OF A TWELVE-YEAR-OLD CHILD

Physical Examination.—Well-developed, poorly nourished child.

Heart: Loud systolic murmur at base, action irregular.

Lungs, liver, spleen, negative.

A large, movable tumor was present in the lower abdomen; free above the pelvis, but not palpable by rectal or vaginal examination. The blood was negative for malaria parasites; hb., 45%. The urine contained albumin and granular casts; and the stool, trichocephalus and ascaris ova.

Treatment.—Laparotomy was performed and a tumor of the right ovary, weighing about 9 pounds, was removed. The uterus was very small, and the left ovary apparently normal.

Gross Description of the Tumor.—The specimen was examined by Dr. H. C. Clark, who reported as follows:

A very large ovarian tumor with adherent rolls of omental tissue over its crest. One small lime-sized protrusion of tumor tissue near adhesions had been ruptured.

The weight of the tumor was 4,075 grams, or about 9 pounds. It was a flattened, globular mass, measuring in its short diameter 5 inches, and its longer diameters varied from 8 to 9.5 inches. It was of rather hard consistency in its lower two-thirds but of quite soft cellular consistency in its upper third. On section of the mass, there appeared an irregular cystic center about the size of a lemon.

Microscopic Report.—The results of the microscopic examination were reported as follows:

A teratoma with a malignant transition of its dome. The capsule and adhesions showed infiltration but no rupture except at the point mentioned in the gross description.

HAEMATOMA OF OVARY IN A GIRL TEN YEARS OF AGE

WENDELL S. DOVE, M.D.

United Fruit Company Hospital

Almirante, Panama

Case No. 23,929, Jamaican negro girl, 10 years of age, was admitted to the Hospital December 3, 1928, at 11 P.M.

Chief Complaint.—Pain in abdomen.

Past History.—No serious illnesses.

Present Illness.—Began with sudden pain in lower abdomen, at 7 A.M. on the day of admission. Vomiting occurred at noon and the patient and her mother stated that she had had fever in the afternoon.

Physical Examination.—Temperature normal; coated tongue; spleen palpable, though not greatly enlarged. There was tenderness, on pressure, in the right lower quadrant below McBurney's point, but no muscular rigidity. The heart and lungs were normal. No vaginal or rectal examination was done.

Laboratory Findings.—Haemoglobin, 65%

White-blood cells, 7,600

Polymorphonuclears, 65%

Urine: Centrifuged urine showed about 100 pus cells per high-power field.

Very faint trace of albumin.

Stool, positive for *Trichocephalus dispar* ova

Progress of the Case.—Following the relief obtained from rest in bed and evacuation of the lower bowel with soap-suds enema, and subsequent normal bowel action and freedom from pain, we made the diagnosis of intestinal parasites and a mild cystitis. On December 8th, chenopodium treatment was given. No further pain or tenderness existed, and the patient was discharged December 11th.

She was readmitted to the Hospital December 14th, at 5 P.M. Her temperature was normal. Pain had begun at noon on the day of readmission. Vomiting occurred before arrival at the Hospital. The abdomen at this time showed no muscular rigidity, although pain on pressure was again elicited in the right lower quadrant. The urine showed only 5 pus cells per high-power field. The patient went to sleep without a narcotic and, considering the location of the pain just above the pelvic brim, we decided to delay operation, to observe the case further. The following day, however, she was suddenly seized with excruciating pain in the lower right quadrant, which was relieved by morphine. Immediate operation was deemed advisable, with provisional diagnosis of ovarian cyst or acute appendicitis. The temperature at the time of operation was 100°F.

Operation.—A right mid-rectus incision was made, and the greatly elongated and thickened appendix was easily located. The vessels of the mesentery and peritoneal covering of the appendix were markedly injected and the appendix itself contained three faecal masses. This condition appeared to show sufficient pathology to account for the symptoms presented in the case. The appendix was removed and the stump invaginated by purse-string suture.

The pelvis was next explored and in the right side a mass the size of a large hen-egg was felt. It proved to be dark in color, and the surface was smooth. The posterior cul-de-sac contained a bloody fluid. The right Fallopian tube was swollen and oedematous, and was partly removed, along with the right ovarian mass. The left ovary was slightly larger than the normal ovary of an adult woman, and contained multiple cysts that appeared to be follicular cysts. The uterus was about the size of a small almond. The abdomen was closed with continuous sutures without drainage. The patient had an uneventful convalescence and was discharged from the hospital on the 12th post-operative day.

Pathological Report:

Gross Pathology.—The specimen consisted of a portion of Fallopian tube attached to a smooth, firm mass nearly black in color, oval in shape, 3 inches long by 2 inches in diameter. Grossly it appeared to be a haemorrhage into ovarian substance which had produced great distension. Grossly, a section of the mass showed trabeculae separated by blood, with several small cavities resembling early cystic degeneration of the ovary. Blood oozed from the tissue, following section.

Microscopic Section.—The cortex of the ovary showed many primordial follicles, some of which were flattened by the distension of the interstices with blood. Below the cortex was a Graafian follicle cyst, the contents of which consisted entirely of blood corpuscles. The membrana granulosa was broken in places, and the blood contained in the interstices apparently was a part of the bleeding that occurred into the Graafian follicle cyst. The blood cells in the tissue immediately surrounding the cyst were more numerous than in the cortex. *Pathological Diagnosis.*—Haemorrhage into the ovary.

COMMENTS

This case demonstrates the necessity of pelvic examination of every female patient, irrespective of age, and the special necessity of exploring the pelvis at the time of an abdominal operation.

Clinically and pathologically the case is an interesting one. According to Graves, internal bleeding may occur into follicular cysts with the production of blood cysts. He quotes von Franque in the opinion that haemorrhages may occur into ovarian stroma in the case of chronic oöphoritis, which causes a special friability of the blood vessels. Graves states further that such haemorrhages take place at the menstrual periods, and that eventually serious symptoms and even death may ensue. However, he declares that as a rule the condition is not a serious one, and that the blood is gradually absorbed.

In this case the symptoms were of sudden onset and showed no tendency to abate. They occurred in a girl who had not menstruated, who had no secondary sexual development, and whose uterus was infantile in size. We certainly were not dealing with a chronically inflamed ovary, and even by close questioning of the mother and of the patient no history of trauma could be obtained. The condition evidently was spontaneous, and it went to the extreme of producing a very acute abdomen.

Considering the multiple cystic condition of the other ovary, and the facts that the haemorrhage into the ovary involved was apparently superimposed on an underlying cystic degeneration, and that the tumor did not exist as a large cavity filled with blood but as an infiltration of the entire ovarian substance,—in view of these facts, we consider the condition as a haematoma resulting from pathological development or pathological atresia of the follicle.

THE SURGICAL TREATMENT OF MACHETE WOUNDS

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Quirigua, Guatemala

PRELIMINARY REMARKS

Special Interest in Machete Wounds.—Ninety per cent of the traumatic cases treated in the Quirigua Hospital comprise machete wounds. Among Central American natives the machete plays a dual rôle of an agricultural implement and a weapon. A majority of the machete wounds, both self-inflicted and received in fights, occur while the victim is under the influence of alcohol. Such wounds are of considerable importance here in the Tropics, because of the frequency of their occurrence, and they are interesting from a surgical viewpoint because of

the surprising resistance of the native laborer to infection and the effects of haemorrhage.

Machete Wounds Classified.—For purposes of analysis machete wounds may be classified as simple and traumatic. Simple wounds are those which effect a clean incision of the involved parts, while traumatic wounds (including the infected) involve surrounding tissues, devitalizing or destroying them. In Quirigua Hospital 70% of machete wounds belong to the first category. Their relative anatomical distribution in cases admitted during the past year, was as follows:

Skull	10	Head and face	40
Neck and face	10	Neck, face and other regions . . .	30
Upper extremities	60	Upper extremities and other	
Lower extremities	15	regions	40
Lower extremities and other		Abdomen	7
regions	2	Shoulder	2
Abdomen and other regions . . .	7	Chest.	1
Shoulder and other regions . . .	7	Back and other regions	3
Back	1		

Most of the wounds of the lower extremities were self-inflicted, incurred in peaceful pursuits, and the majority of them were at or near the knee, not infrequently involving the knee joint. Most of the wounds of the upper extremities were incurred in fighting.

Treatment.—The results obtained in the treatment of machete wounds depend upon many conditions, the most important of which are as follows: extent of traumatic destruction of tissue; character of first-aid treatment; length of time elapsing before hospitalization; the presence of infection; general resistance of the patient; amount of blood lost; and the complicating influences of such diseases as malaria, syphilis, pneumonia and alcoholism. The character of the first-aid treatment given in field dispensaries is probably the most important factor in determining the success or failure of hospital treatment.

Upon the patient's admission to the Hospital, every wound should be considered infected. The treatment which has yielded the most satisfactory results is carried out as follows: The wound is protected with sterile gauze; then the surrounding skin is thoroughly scrubbed with a hand brush and green soap, and shaved. Next, the wound is flooded with 1,500 cc. of bichloride of mercury solution 1 to 4,000, followed by a deep irrigation with a warm saturated solution of boric acid. Then the wound is dried and the skin treated with tincture of iodine followed by alcohol. Haemostasis is accomplished and the incision lightly packed with gauze saturated with mercurochrome solution 2%. A sterile dressing is applied.

The application of corrosive sublimate and mercurochrome solutions has not given rise to any symptoms or signs of undue absorption, even when used in deep and extensive wounds. Irrigation with saturated solution of boric acid—a prac-

tice initiated in this Hospital by Doctor E. B. Ross—has been used for a number of years and has yielded uniformly good results.

Suture of Wounds.—All wounds which open into a cavity—such as the abdominal, pleural or buccal—are sutured at once. Simple wounds are closed within 48 hours after application of the first hospital dressing, if there is no gross evidence of infection.

Suture material should be carefully selected and adequate drainage provided, in order to obtain the best results. Wide exposure of the wound depths, and thorough application of mercurochrome to the entire exposed surface; elimination of pockets in the deep tissue by inserting interrupted deep sutures; and the use of the skin clips for skin closure; all these have become routine measures. Chromic cat-gut is selected for the repair of tendons and aponeuroses. The material of choice for drainage is rubber-dam, which is replaced within a few days by gauze wicks saturated with mercurochrome solution. No immediate attempt is made to unite complicating fractures by mechanical means. Excision of fragments is sometimes indicated in cranial bone injuries, and also in fractures of the mastoid, zygomatic, superior-maxillary and orbital processes. Skull wounds involving the tables are rarely closed before the 6th day, because of the danger of meningitis from extension of a deep tissue infection.

Infected Wounds.—These are of course not sutured. They are packed with gauze, wetted at intervals with saturated boric-acid solution; or, in the case of deep wounds, irrigated and packed lightly with gauze saturated in mercurochrome solution.

CASE REPORTS

Case 1

History.—M. G., male, native, aged 27, was admitted to the Hospital on January 26, 1927. While at work on the morning of the 26th, he received a machete wound over the outer part of the lower third of the left leg. The wound was about 3 inches long, extending transversely through the aponeurosis of the tibialis anticus muscle. The temperature was normal and there was no complaint of pain, nor were there any symptoms of inflammation.

Treatment.—The field was prepared as already described and a wet dressing of mercurochrome applied to the wound, which was closed the next day with metal clips. The patient was discharged on February 1st, in good condition.

Case 2

History.—F. D., native, male, aged 21, was admitted to the Hospital on February 7, 1928, with a machete wound over the inner surface of the right knee, received accidentally while at work about noon on the day preceding. It was an incised wound about 1 inch long extending through skin and cellular tissue only. The temperature was normal, although the blood was positive for tertian malaria parasites.

Treatment.—The field was prepared according to our routine method and the wound sutured with metal clips. The patient was discharged on February 18th, in good condition.

Case 3

History.—D. L., native, male, aged 28, was admitted to the Hospital on February 9, 1928. While fighting with two other laborers during a drunken brawl, he received 2 machete wounds on the right forearm and hand. The extent of the patient's injury was revealed as 2 incised wounds, one of them over the ulnar surface of the lower third of the right forearm, about 1 inch long and extending through the aponeurosis of the flexor carpi ulnaris; the other wound involved the dorsum of the index, middle and ring fingers, extending through skin and cellular tissues to the bone, and completely amputating the distal phalanx of the 4th finger. The patient's temperature was normal, although the blood was positive for E. A. malaria parasites.

Treatment.—The wounds were dressed with mercurochrome solution and sutured the following day under ether anaesthesia. The patient was discharged on February 16th, in good condition.

Case 4

History.—V. M., native, female, aged 23 years, was admitted to the Hospital on September 8, 1928, suffering from profuse haemorrhage and shock from multiple machete wounds. The temperature was 100°F. and pulse rate 140 of poor volume and thready. Her husband had struck her with a machete, in an attack of jealousy. She presented the following wounds:

(1) Over left temporal region, about 8 inches long, making a downward flap of the left ear and part of the external table of the temporal bone, and involving the auditory meatus and part of the mastoid process, dividing the temporal artery and vein and auriculo-temporal nerve.

(2) Over the right parietal region, about 6 inches long through outer table of the right parietal bone.

(3) Left hand cut entirely across the palm, down to metacarpal bones.

(4) In ulnar region of middle third of left forearm, about 3 inches long extending through the extensor carpi ulnaris and flexor profundus digitorum muscles, and partially dividing the ulna bone.

(5) Flap of bone anterior-posteriorly about 3 inches long in the middle third of ulnar side of right forearm through flexor profundus digitorum and flexor carpi ulnaris, and flapping part of the shaft of the ulna bone.

(6) Over right side of lumbar region, longitudinal, about 12 inches long through quadratus lumborum muscle, fracturing the right transverse process of the 4th lumbar vertebra.

Treatment.—This consisted of stimulation, hypodermoclysis, and dressing of the wounds in the manner described previously in this article. Fourteen hours

later the dressings were changed, and next day the wounds were sutured under ether anaesthesia. The tendons and muscle aponeuroses were sutured with chromic cat-gut; the flap of the mastoid process was resected; the rest of the small loose fracture fragments were taken away; and the skin was sutured with silk worm-gut and drainage provided with rubber-dam. The wounds were dressed daily, and splints were applied to both arms.

The wounds of the left hand and lumbar region showed mild suppuration on the 3rd day, and saturated solution of boric acid was applied on wet dressings. Rubber drainage was discontinued in all wounds, and small gauze drainage soaked with mercurochrome substituted for 5 days. Sutures were removed on the 11th day and the wounds of hands and lumbar region left open. The patient developed pneumonia and pleurisy on September 17th. She was discharged from the Hospital on November 9th, with slight limitation in extension of left hand, but otherwise in good condition.

Case 5

History.—V. V., native, male, aged 20, was admitted to the Hospital on February 3, 1927, with an infected machete wound extending into the joint of the right knee, and received accidentally on January 29th while he was at work. The temperature was 100°F.; pulse 78; blood, negative for malaria parasites; urine and stool, negative.

Treatment.—He was given boric-acid solution irrigations, followed by drainage with gauze saturated with mercurochrome. Flexion and extension of the leg were practiced to prevent stiffness of the knee. The patient was discharged from the Hospital on March 16th, with perfect use of the knee.

Case 6

History.—J. C., native, male, aged 28, was admitted to the Hospital on May 3, 1928, with a machete wound over the left knee received while at work the day before. Examination revealed an incised wound located over the inner aspect of the left knee, about 2 inches long and involving the knee joint. Temperature and pulse, normal; blood, negative for malaria parasites; urine, negative.

Treatment.—The wound was thoroughly cleansed and mercurochrome wet dressing applied. The following day under spinal anaesthesia it was sutured without drainage. The patient was discharged from the Hospital on May 14th, in good condition.

Case 7

History.—A. R., native, male, aged 25 years, was admitted to the Hospital on May 5, 1928, with the following wounds, which were inflicted in a machete fight on that day:

(1) Incised wound on the left side of the forehead, about 3 inches long, longitudinal, and extending through the external table and diploe of the frontal bone.

(2) Incised wound about 4 inches long over right temporo-zygomatic region, dividing the pavilion of the ear.

Treatment.—Boric-solution irrigations and mercurochrome wet dressings were applied. The wounds were sutured the following day under ether anaesthesia. The wound of the forehead was closed with metal clips; that of the temporo-zygomatic region, with plain silk. Small gauze drains wet with mercurochrome solution were left in both wounds for 24 hours. Sutures were removed on the 7th day. The patient was in good condition when discharged from Hospital.

Case 8

History.—E. D., Jamaican negro, aged 34, was admitted to the Hospital on May 11, 1928, having received in a fight the following 3 machete wounds:

(1) Over the middle of the forehead about 5 inches long extending through the external table of the frontal bone.

(2) Over the left supra-orbital arch, vertical, and $1\frac{1}{2}$ inches long, cutting through the upper and lower eyelids.

(3) On the left side of the face, longitudinal, about 7 inches long, exposing the maxillary sinus, buccal cavity and lower jaw bone.

Treatment.—After a thorough cleansing irrigation with boric-acid solution, mercurochrome was applied to the wounds and the surrounding skin was painted with tincture of iodine. The wounds were sutured under general anaesthesia within an hour after the patient's admission to the Hospital. The wound of the forehead was closed with metal clips; the eyelids with plain silk; the buccal mucosa and muscles with chromic cat-gut; the skin of face with silk-worm-gut. The maxillary bones and alveolar process were approximated and not sutured. Gauze drainage wet with mercurochrome solution was left in the forehead and face wounds until the 2nd day. The mouth was cleansed daily with boric-acid solution. The temperature rose from 100° to 102° after the operation, but returned to normal on the 3rd day. The sutures were removed on the 6th day, and the patient was discharged from the Hospital on May 26th, in good condition.

Case 9

History.—F. Z., male, native, aged 23, was admitted to the Hospital on April 28, 1927. While in a drunken brawl on the night before admission, he was cut across the chest with a machete, receiving an incised wound about 5 inches long, extending transversely across the chest, severing fibers of the pectoralis major muscle, and cutting on through skin and subcutaneous tissue down to the sternum. The wound had not been dressed. The blood was negative for malaria; temperature, 99; pulse, 92.

Treatment.—The wound was immediately cleansed and prepared according

to the routine already described. General anaesthesia was given and the muscle sutured with chromic cat-gut, skin with metal clips, and no drainage provided. The sutures were removed on the 6th day, and the patient was discharged, in good condition, on May 5th.

Case 10

History.—P. A., native, male, aged 40, was admitted to the Hospital on February 10, 1927, in a condition of shock. Temperature, 99; pulse, 124, weak and thready. He presented 2 incised wounds, as follows:

(1) Over the left parietal region, about 4 inches long and extending through skull and meninges.

(2) About 12 inches long, extending across left temporal region and neck, excising part of the ear and cutting through portions of the trapezius, splenius capitis, semi-spinalis capitis, and levator scapulae muscles, and through the periostium of the temporal bone.

Treatment.—Stimulation and a hypodermoclysis were given. The patient was operated 2 hours after admission. The operative field was prepared according to the writer's routine, and the wounds of the neck and temporal region were sutured and drainage provided. The wound of the parietal region was left open. Careful haemostasis was effected, after which the wound was thoroughly irrigated with a saturated solution of boric acid, followed by a dressing of gauze wet with mercurochrome solution. This treatment was continued for 5 days, whereupon the scalp over the parietal wound was approximated with 3 interrupted sutures. The patient was discharged on March 25th, in good condition.

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SECTION V.

DISEASES OF THE EYE ENCOUNTERED IN HONDURAS

W. E. MULDOON, M.D.

Tela Railroad Company Hospital

Tela, Honduras

PRELIMINARY REMARKS

Because of the comparatively short time spent in Tela, Honduras, ($2\frac{1}{2}$ months) and the small number of patients seen, not many conclusions can be drawn. Nevertheless, several features of interest are to be noted. One is the hitherto unsuspected presence of glaucoma (8 cases). Of these 8 patients, 2 were totally blind in both eyes, while 2 more were blind in 1 eye and had contracted fields in the other. The remaining patients had contracted fields, and lowered visual acuity in 1 of the 2 eyes.

Pterygium is extremely common as compared to its occurrence in a similar group of patients in the United States. It is more common in towns such as San Pedro and Tegucigalpa than on the coast. The probable reason is, that in the towns of the interior the rainfall and humidity are lower, and where there is traffic, the great amount of dust keeps the eyes constantly irritated.

Five cases of scleritis were found, all in patients who had a positive Wassermann reaction; and all improved under antiluetic treatment. This affection is uncommon in the United States, where it is as frequently considered "rheumatic" or tuberculous as it is deemed luetic in origin.

Twelve cases of macular choroiditis were seen, an unusually high incidence (about 3% of all the patients examined). The reason for this is not obvious. The disease was apparently not due to syphilis. Undoubtedly among the contributing factors, are the prevalence of focal infections in the teeth and tonsils, and a faulty diet.

Only one case of dendritic ulcer was observed, and this was in a man who did not have malaria. That fact is noteworthy because of the oft-repeated but probably unsubstantiated statement that one of the frequent causes of dendritic ulcer of the cornea is chronic malaria.

Acute catarrhal conjunctivitis is quite prevalent and at times assumes epidemic proportions. The Koch-Weeks' bacillus is generally the causative factor, although in a few cases the pneumococcus and the Morax-Axenfeld bacillus have been found. In Honduras the Koch-Weeks' bacillus causes a more severe form of conjunctivitis in cases occurring among the native population than in cases observed in the United States.

Corneal ulcer is a frequent complication. One case had ulceration of about two-thirds of the cornea, and pus in the anterior chamber of the eye three days after the onset of symptoms of the infection. Another case lost the vision of one eye from panophthalmitis following the perforation of an ulcer, and the cornea of the other eye was badly scarred.

Following is a detailed tabular statistical classification that may be of special interest in connection with the remarks which have just been made:

STATISTICAL SUMMARY

REFRACTIONS:

Employees	104
Families of employees	36
Other non-employees	75
Total	<u>215</u>

REFRACTIVE ERRORS:

Emmetropia	5
Hyperopia	61
Myopia	8
Simple hyperopic astigmatism	5
Comp. hyperopic astigmatism	92
Comp. myopic astigmatism	22
Simple myopic astigmatism	8
Mixed astigmatism	14
Presbyopia (associated with one of the above)	66

PATIENTS EXAMINED FOR OTHER THAN REFRACTION:

Employees	121
Families of employees	23
Other non-employees	31
Total	<u>175</u>

DISEASES OF MUSCLE:

Paralysis of extra-ocular muscles	2
Paralysis of orbicularis	1
Squint, convergent	6
Squint, divergent	4

DISEASES OF GLOBE:

Pthisis bulbi	3
Glaucoma, chronic, simple	8
Glaucoma, chronic, congestive	4
Glaucoma, secondary	3
Panophthalmitis	2

DISEASES OF SCLERA:

Scleritis	5
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DISEASES OF IRIS AND CILIARY BODY:

Iritis	5
Uveitis, acute	1
Uveitis, chronic	5
Irido-dialysis, traumatic	1

DISEASES OF LENS:

Cataract, senile	16
“ congenital	4
“ traumatic	2
“ complicated	4
Aphakia (post-operative)	5

DISEASES OF OPTIC NERVE:

Primary optic atrophy (both eyes)	1
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DISEASES OF LACHRYMAL APPARATUS:

Dacryocystitis, chronic	3
Lachrymal duct, obstruction of	2

DISEASES OF CHOROID AND RETINA:

Chorio-retinitis, macular, old	11
Chorio-retinitis, macular, recent	1
Choroiditis, other	4
Rupture of choroid (traumatic)	1
Hole in macula (traumatic)	1
Detachment of retina	1
Proliferative retinitis	1
Color-blindness	4

DISEASES OF LIDS:

Entropion	3
Subcutaneous, haemorrhage, traumatic	1
Emphysema	1
Blepharitis	6
Chalazion	5

DISEASES OF CONJUNCTIVA:

Subconjunctival haemorrhage (traumatic)	1
Trachoma	7
Conjunctivitis, follicular	10
“ chemical	1
“ acute catarrhal	19
“ chronic catarrhal	12
Pterygia	27
Pinguecula	6

DISEASES OF CORNEA:

Ulcer, catarrhal	5
“ dendritic	1
“ hypopyon	1
“ perforating, old	1
Keratitis, interstitial	2
“ other (scars from injuries and previous inflammations)	5
“ superficial punctate	2
Phlyctenular kerato-conjunctivitis, old	1
Injury, perforating of, old	5
“ perforating of, recent	1
Abrasion of	5
Foreign bodies in	8

OPERATIONS PERFORMED:

Lids, entropion, plastic for (panas)	2
“ entropion, cautery puncture	4
“ chalazion, excision of	2
Lachrymal apparatus, lachrymal sac, extirpation of	3
“ “ lachrymal gland, extirpation of	1
“ “ lachrymal ducts, probing	8
Conjunctiva, pterygia, transplantation of	25
“ pterygia, excision of	2
Cornea, foreign bodies, removal of	12
“ tattooing of	1
Lens, cataract, extraction with iridectomy	9
“ cataract, linear extraction	1
“ capsulotomy	2
Globe, enucleation	3
“ evisceration	2
Sclera, glaucoma, Elliott trephine for	1
“ glaucoma, LeGrange sclerectomy	2

RAILROAD EMPLOYEES EXAMINED FOR COLOR VISION AND VISUAL ACUITY:

Total Number Examined, 61:

Approved	46
Approved with glasses	10
Disapproved	5

OTOMYCOSIS—CASE REPORT

L. M. DRENNAN, M.D.

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PRELIMINARY REMARKS

Fungus disease of the external auditory canal has been recognized and treated by the medical profession for a great many years. Favored by an ideal, moist, hot climate which prevails in many tropical and subtropical countries, fungus growths of every description are of frequent occurrence. In spite of these facts, however, many such infections in the ear escape recognition.

In this Division, especially during the hot, rainy months, this ear infection is a frequent complaint; and in most of the cases is due to either *Aspergillus negra* or *A. flavus*, with the latter predominating.

Such cases are not always as easy to cure as one would imagine, often requiring meticulous care and treatment over a long period; and in some, relapses occur even after the disease has been apparently cured. The following case report exemplifies these facts:

CASE REPORT

History.—J. W. S., white, foreign, engineer, resident of the farm area, came to the clinic complaining of soreness, itching, and some pain, in both ears, which he stated had troubled him several days. A slight sticky discharge from the ears was noted.

Examination and Treatment.—Otoscope examination showed involvement of both ears. The auditory canals were very sensitive, and partially occluded by crusts and scales. On one side, the drum was involved. The patient was treated with various cleansing, antiseptic remedies, there was apparent improvement, and he was discharged with the advice that he continue the same curative measures.

He returned a few weeks later and reported that he was still suffering. Examination at that time showed a yellowish-white extraneous exudate adherent to the sides of, and almost filling, the auditory canals; its removal not only was painful, but produced bleeding. As the drum membrane on one side had become involved, hearing was considerably interfered with. For the first time a fungus growth was suspected. Specimens were cultured, and the laboratory reported a prolific growth of *Aspergillus flavus* within 24 hours. The patient was at once admitted to the Hospital, and for several days was treated vigorously with a 10% alcoholic solution of salicylic acid. As this treatment was quite severe, it was soon discontinued, and a 15% solution of hyposulphite of soda was substituted.

Results.—He made a rapid recovery, and for 2 years has been without further ear trouble. Recent examination showed his auditory canals, drum membranes, and hearing, to be in perfect condition. This was very gratifying, as at one time during his illness the drum on one side was so badly affected that a cure without a partial or complete hearing defect seemed improbable.

COMMENTS

In the past two years I have encountered several similar cases of varying degree and intensity, which have responded to this form of treatment. Some of the milder cases do well with irrigations of the hyposulphite solution only; others do better when this is alternated with irrigations of warm bicarbonate of soda solution.

I have reported this case as it may interest other persons, and because it demonstrates the importance of having cultures made when possible, in rebellious inflammations of the external ear. It confirms the diagnosis and thus indicates the line of treatment which should be followed.

Naturally, secondary infections often invade lesions of this character. Complications of this kind only tend to aggravate the disease, and otherwise add to the discomfort of the patient. The sensitiveness and pain in such cases where the deeper cellular tissue becomes involved are so great that even the slightest

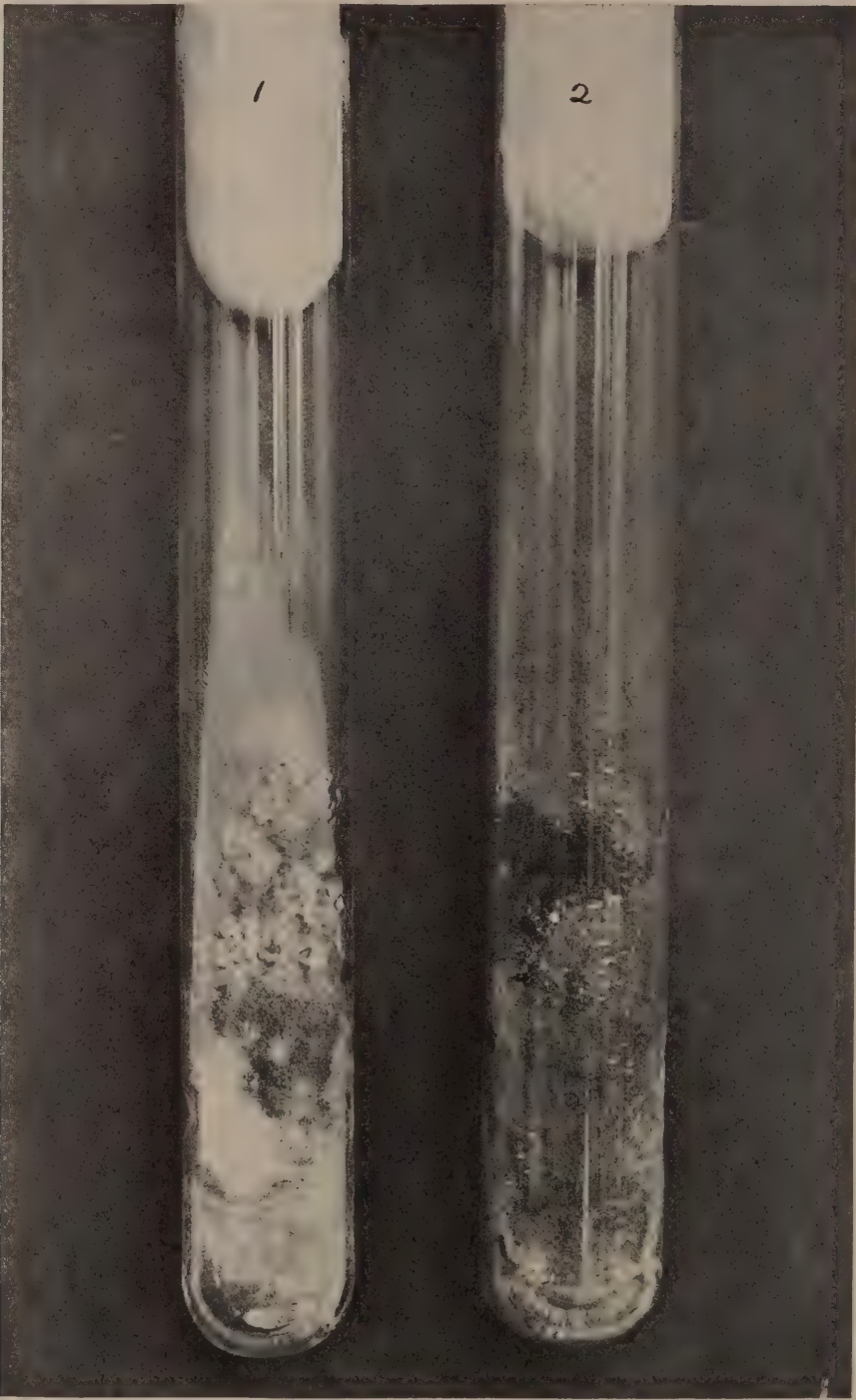


FIG. 1

FIG. 2

movement causes pain. Aluminum acetate, 10–15%, in lanoline, is often helpful in associated infections of this type.

The accompanying illustrations of the culture in one of our cases reveals its character and the rapidity of the growth. The detail as to color is not well brought out. Figure 1 shows a recent prolific yellowish-white growth that occurred in about twenty-four hours. Figure 2 shows the same specimen several days later, indicating the usual greenish characteristics of older molds of this type.

HAEMOGLOBIN SURVEYS IN LABOR CAMPS OF THE BANANA DIVISIONS (MAINLAND OF CENTRAL AMERICA)

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Tallquist Method Used.—The field surveys during the summer of 1928, in which a comparison of the spleen rate and the parasite rate was conducted, offered a chance to record the haemoglobin index on the same individuals. The Tallquist method was employed, since it had proved to be of service in Haiti where a rapid application of the test was made on thousands of labor recruits. No attempt was made to read the test between the scale of tens. The results are shown below:

TABLE OF HAEMOGLOBIN DETERMINATIONS

Divisions	% 30	% 40	% 50	% 60	% 70	% 80	% 90	% 100
Colombia	1	1	23	133	309	196	26	0
Tela R. R.	6	3	4	83	427	213	3	0
Costa Rica	0	4	14	195	379	130	30	0
Panama	0	2	12	81	207	202	40	0
Guatemala	1	7	78	245	400	98	5	0
Truxillo	3	5	14	167	288	88	2	0
Chiriqui	2	15	20	103	259	671	301	5
	13	37	165	1,007	2,269	1,598	407	5

Chiriqui Land Company Survey.—The people in the Chiriqui Land Company Division were comparatively new arrivals in this lowland district, having come chiefly from the highland levels of Panama and Nicaragua, and from the City of Panama. A number of foreign-white men were also included in the general survey of this Division.

These 5,501 people (all Divisions) show, when classified by their haemoglobin index:

Individuals with Hb. Index of	Per cent
30%	0.23
40%	0.67
50%	2.9
60%	18.3
70%	41.3
80%	29.1
90%	7.4
100%	0.09

Concluding Remarks.—It can be seen that the bulk of our banana laborers and their families (excluding those of Chiriqui Land Company) scale from 60% to 70% in haemoglobin. Their ability to do manual labor in a consecutive daily manner is probably below what would seem to be indicated by their haemoglobin rate.

These rates conform closely to those of the survey made last year on 11,000 adult male Haitian negroes.

Probably three conditions are mainly responsible for this low index. If I were asked to place the three reasons in what I believe to be their order of importance, I would list them as follows: malaria, malnutrition, and intestinal parasites.

BLOOD STUDIES IN INFLUENZA

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PRELIMINARY REMARKS

Influenza Diagnosis.—The diagnosis of influenza depends largely on its epidemic character, as the incidental association of the Pfeiffer bacillus and the variety of the clinical aspects of the disease have sufficiently demonstrated during the past great epidemics. Furthermore, studies of the blood pictures in influenza, which were performed on a broad scale during the epidemic of 1918, differed rather widely in their results. Rosenow¹ found a neutrophilia with disappearance of the eosinophiles during the first days of the infection, which changed to a post-infectious lymphocytosis. However, v. Jagic¹ stressed the fact that in his cases the eosinophiles did not disappear. Berger² has given a synopsis of the differing opinions and came to the conclusion that uncomplicated influenza infection showed a leukopenia, whereas the presence of a relative leukocytosis is due to mixed infections. Reicher,³ on the other hand, considered the leukopenia with relative

lymphocytosis such as appears in typhoid fever, to be an exception, but observed, especially in the onset, an increase of the large mononuclears.

So far as my knowledge of the literature is concerned, the appearance of young, immature leukocytes or the "nuclear shifting to the left," as Arneth termed it, was not taken into consideration in those cases. The nomenclature which I propose to use in this paper will signify young forms (Fig. 1) as extremely young neutrophils, and staff forms (Fig. 2) as slightly more mature cells. As the nuclear shifting or changes in the relative number of the young and intermediate forms has proved itself a very delicate indicator regarding prognosis and differential diagnosis, I applied it to my blood studies during the recent influenza epidemic, the results of which are herein submitted.

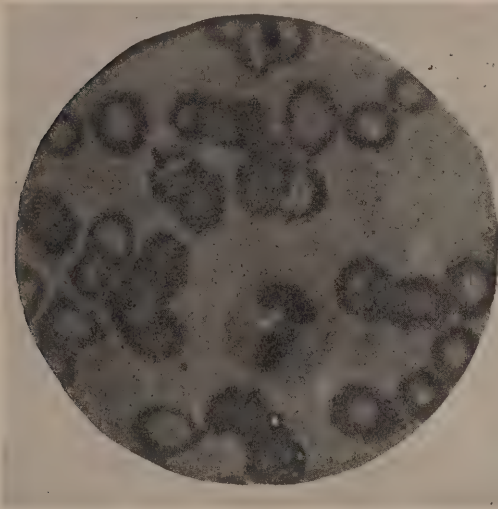


FIG. 1. EXTREMELY YOUNG NEUTROPHILES (YOUNG FORMS), WITH SINGLE FLAT SEGMENTATION OF NUCLEUS

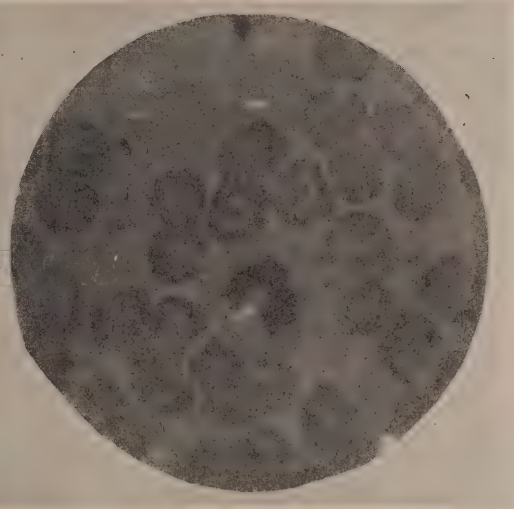


FIG. 2. SLIGHTLY MORE MATURE NEUTROPHILES (STAFF FORMS), WITH SINGLE DEEP SEGMENTATION OF NUCLEUS

Remarks on the Epidemics.—Let me say a few words regarding this epidemic and its character in general. It started in our Division in the middle of the month of August, 1928. In September the number of cases lessened; then, early in the month of October, they increased considerably in number as well as in severity. The majority of the 35 cases referred to in this paper date from this last period, of which there were:

22 West-Indian negroes
12 colored Latin-Americans
1 Indian

Only 2 of the 134 cases occurring in the epidemic were fatal; both being West-Indians. Among the symptoms were catarrhal affections of the upper respiratory tracts; 3 cases were complicated by bronchopneumonia; and about 50% presented intestinal symptoms among which gastric distress predominated.

Fever in Influenza.—While a characteristic fever chart of influenza does not apparently exist; yet in the larger number of cases there is a short initial rise followed subsequently by temperature relapses at irregular intervals, with intervening days of normal or slight temperatures. In order to study the individual case during the course of infection, several blood counts, up to 8, were done. A thin film was made and stained with Wright's stain, and blood for haemoglobin estimation and absolute cell counts was taken, immediately before lunch, about 4 hours after breakfast. As the period of incubation in influenza is very short and only a small number of the cases acquired their infection in the Hospital, only one case was observed in the prodromal stage, and this will be reported later in detail.

Haemoglobin and Red-blood Cells.—The majority of the patients remained in the Hospital over a period averaging 8 days, so that there was no noticeable effect either upon the haemoglobin or upon the red cells. Morphological changes in, and pathological types of, erythrocytes were rarely observed. Only 1 case, which suffered simultaneously from tertiary syphilis and uncinariasis, showed a slight anisocytosis; and 1 erythroblast was found during the infection.

Only in the beginning of the epidemic was the absolute number of leukocytes an object of our studies, as during its course it became evident that their numbers varied widely,—often without an explicable relation toward the other symptoms of the infection.

The differential count was especially interesting. The relative number of the neutrophilic leukocytes proved to be low or normal at the onset of the infection, i.e., at the appearance of the first clinical symptoms and during the initial fever period. They varied between 50 and 70% of the total leukocyte count. During the course in uncomplicated cases they rose steadily toward the end of the infection, reaching 80 to 85%, to fall again to normal relative percentages in the post-infectious stage.

Nuclear Shifting of the Neutrophiles.—At the beginning of the initial fever period an intense regenerative shifting of the character of the nuclei to younger types took place. Instead of the normal number of 4 staff or young forms in 100 white cells, we observed that as many as 50 of the neutrophiles were either staff or young forms, and occasionally even myelocytes were present. As the percentage of the neutrophiles was rather low at this period, the mature segment forms were often outnumbered by the juvenile forms. In the same degree during the course of the struggle when a slight neutrophilia made its appearance, the nuclear picture shifted back from the left to the right or to mature forms until a normal or only slightly increased number of young cell forms was reached in the post-infectious period,—provided the case was uncomplicated. A delay in the progress of the struggle against the infection declared itself by a persistence of the presence of a large number of the young forms of neutrophiles; while in the case of a complication, such as a bronchopneumonia, for example, an increase was seen.

The lymphocytes, as a rule, ran a course parallel to that of the young and staff forms of the neutrophiles. The first days of the average influenza case were characterized by a marked lymphocytosis. This increase gave way gradually, toward the end of the infection, to normal or subnormal numbers. During convalescence a new rise in the number of lymphocytes was frequently observed for a period of 2 or 3 days.

The behavior of the large mononuclears was not uniform. Two-thirds of the cases showed a relative increase at the onset, which subsided as soon as the fever dropped. One-third of the patients gave a different and rather irregular picture regarding the mononuclears. In those cases, which showed a big spleen, they were generally increased so that it appeared possible that chronic malaria may have had some influence.

The eosinophiles maintained a very uniform ratio throughout. A complete absence was noted from the beginning to the end of the infectious period in all uncomplicated influenza cases. During the convalescence the acidophile cells returned to normal numbers or were relatively increased.

Slight signs of degenerative processes in the hematopoietic system were marked in some of the more prostrated cases. There occurred toward the end of the infectious phase a relative basophilia, which however disappeared in the convalescent period, if observation was sufficiently prolonged.

Regarding Prognosis.—Toward the end of the epidemic we regarded the haemogram as a rather delicate indicator of the prognosis of the disease. The ratio between the neutrophiles and lymphocytes gave us a fairly good indication of the progress of the struggle between the organism and the infection. A slow increase in the neutrophiles was a favorable sign, provided that the beginning neutrophilia was accompanied by the decrease of the staff and young forms. This nuclear shifting was indeed prognostically the most important feature of the blood picture. Even before a sudden increase of the leukocytes and the large mononuclears indicated the presence of a complicating factor, as, for instance a small bronchopneumonic focus, the nuclear shifting to the left took place and made it possible to anticipate an oncoming complication. On the other hand, a new rise of temperature after a few days of remissions did not disturb the return of the nuclear shifting to normal numbers, provided a genuine relapse did not occur. The subjective complaints of an influenza patient seem often out of proportion to the objective signs. We observed that there existed a parallelism between the subjective symptoms and the nuclear shifting. For example, we noted in cases with slow convalescence (often a week after the definite drop of temperature) a similar retardation of the reestablishment of the normal nuclear shifting numbers.

The reappearance of the eosinophiles indicated generally the end of the influenza infection. As there was a large number of the patients simultaneously infected with intestinal worms, we disregarded the often-observed increased

number of eosinophiles during the convalescence as an essential feature of this period of the influenza.

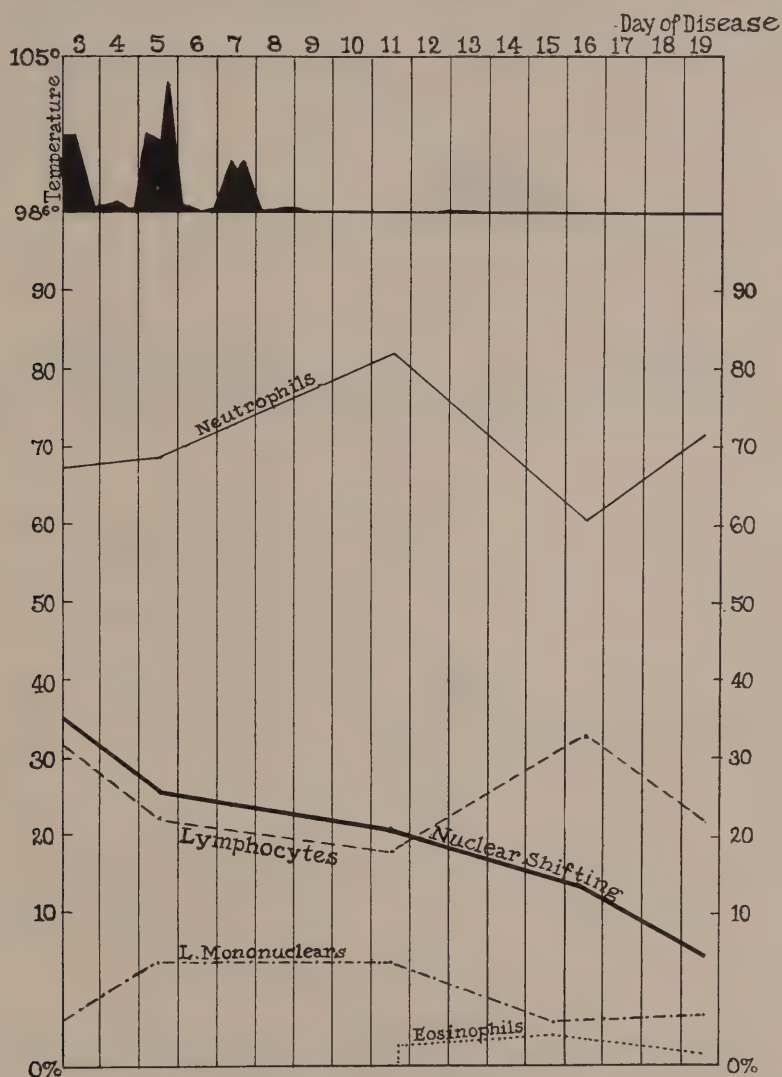
Regarding Differential Diagnosis.—In a preceding paragraph, dealing with the prognostic value of the haemogram, the differentiation of an uncomplicated influenza infection from a case with a secondary infection was mentioned. During, as well as after, the epidemic we had occasion to check up our group of influenza patients with other cases of acute respiratory infections in which the symptomatology justified differential diagnostic considerations. We were able in a number of cases to confirm the findings of Becker,⁴ who states that acute diseases of the respiratory organs showed a neutrophilia, but scarcely ever a nuclear shifting. We are of the opinion that this statement should be limited to the acute diseases affecting only the upper respiratory tract. In these cases the differential diagnosis was very much simplified through the aid of the blood picture. More difficult was the differentiation of those cases which were suffering from an acute respiratory infection, and which showed the signs of having had a previous malaria infection (splenomegaly) from a possible "clinical" malaria, as the blood picture of chronic malaria is almost the same as that of influenza at the onset, namely relative increase of the large mononuclears and lymphocytes, but with nuclear shifting to the left. The above-described changes which took place during the course of the illness in the cases of influenza, however, revealed the difference.

CASE REPORTS

Case 1.—Chart No. 23,574, male, colored, Latin-American. *Clinical Diagnosis:* Influenza, splenomegaly. The diagram of this patient's fever and blood chart is characteristic for the average uncomplicated influenza infection. Note the discrepancy between the low normal number of neutrophiles and the high nuclear shifting percentage on the 3rd day of the disease (day of admission). The nuclear shifting number (young forms) drops steadily, when the neutrophiles reach their maximum. Typical also is the parallel course of the lymphocytes with the young forms of neutrophiles during the infectious period, as well as the short lymphocytic period and the reappearance of the eosinophiles in the convalescence.

Case 2.—Chart No. 23,023, male, Indian. *Clinical Diagnosis:* Influenza following aestivo-autumnal malaria. This patient had just recovered from E. A. malaria, and was still weak and anaemic (Hb. 45%) when he contracted influenza (hospital infection). In order to determine his type of anaemia, on the 13th day of his sojourn in the Hospital the first differential count here charted was done. This was before he showed any symptoms of influenza. The prompt nuclear shifting to the left during the prodromal stage goes together with a slight drop in the relative number of the neutrophiles. The following short period of neutrophilia is synchronous with the return of the nuclei to more normal numbers.

The lymphocytosis precedes the nuclear shifting at the onset of the disease, and drops again rather quickly. A second slight lymphocytosis follows in the convalescent period. The reappearance of the eosinophiles at the time of the defini-

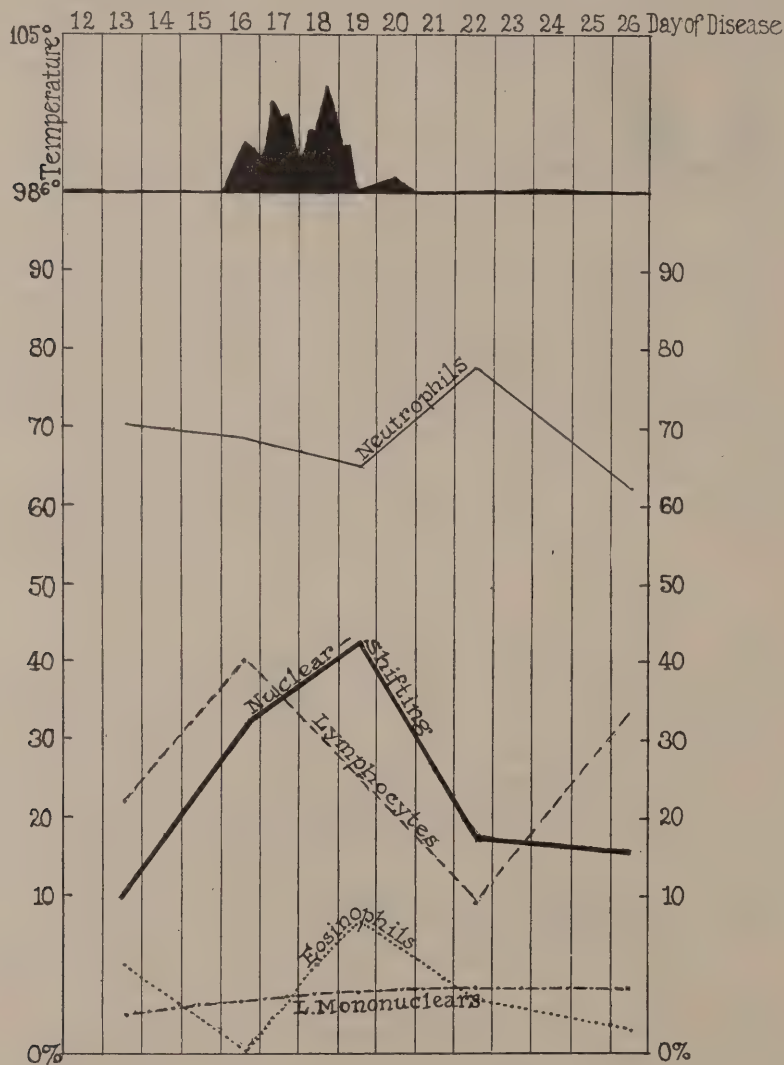


CASE 1 (CHART No. 23,574)

tive drop of the temperature, is another striking feature of this picture. The mononuclears show a steady increase which is atypical.

Case 3.—Chart No. 23,558, male, colored, Latin-American. *Clinical Diagnosis:* Influenza, complicated by sinusitis frontalis. The clinical picture of this case was that of a long-protracted struggle. It started with the symptoms of

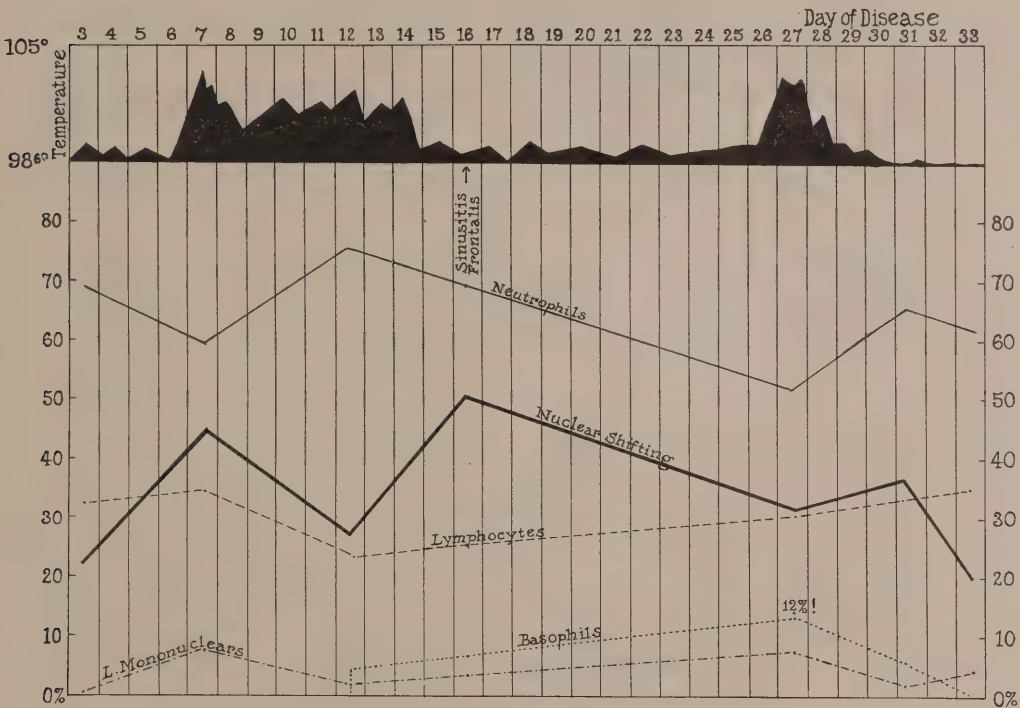
stomach distress (1st to 6th day of the disease). Although there was no increase in the relative number of the neutrophils and there was a low temperature, the nuclear shifting to the left indicated already a continuation of the infection. On the 7th day with high fever catarrhal symptoms (coryza) appeared. The



CASE 2 (CHART No. 23,023)

general condition on the following days was good, and there seemed to be a distinct improvement (satisfactory relative neutrophilia, return of the nuclear shifting to normal numbers), when on the 15th day of his disease the patient's blood showed a renewed nuclear shifting to the left, and this coincided with the appearance of the symptoms of a frontal sinusitis. Although at this time the

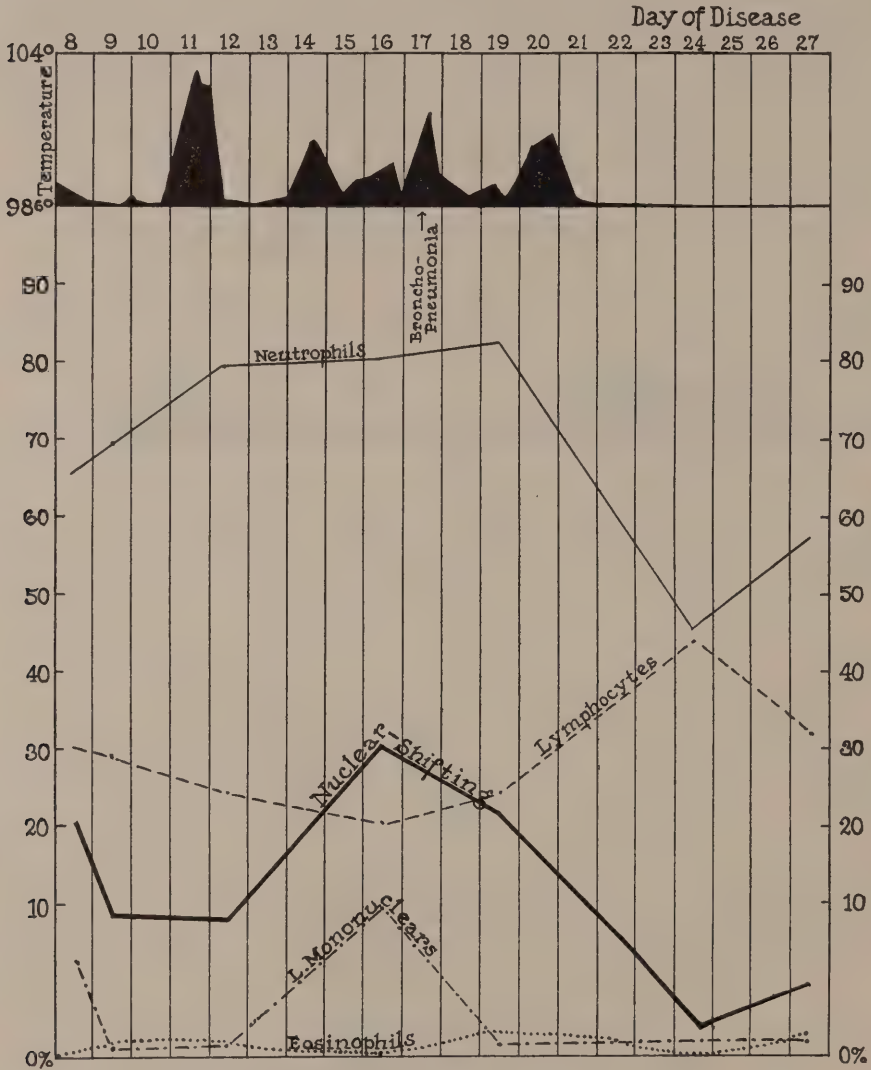
temperature had already dropped, the patient felt very badly, and, instead of the expected neutrophilia, a slight drop in the relative number of neutrophils occurred. There was evidently a pretty severe exhaustion of the bone marrow, a supposition which was confirmed by the appearance of basophile leukocytes in the blood picture, and this we consider as symptomatic of certain degenerative processes in the haematopoietic system. Note the roughly parallel course of the lymphocytes and the nuclear shifting during the infectious period, and the 2 high peaks of mononuclears coincident with the high fever records. The convalescence was slow, and incomplete when the patient was discharged (with the absence of the eosinophiles, and 20% young forms of neutrophils).



CASE 3 (CHART No. 23,558)

Case 4.—Chart No. 23,842, male, West-Indian. *Clinical Diagnosis:* Influenza, complicated by bronchopneumonia. The haemogram of this case illustrates well the early response of the nuclear shifting to an oncoming complication. On the 15th day of the disease, after running a rather benign course the nuclear shifting number rose from 10% to 33%. On the same day the patient felt well, the temperature was low, and the neutrophilic percentage was satisfactory. The next day the patient felt worse, a new rise of the temperature occurred, and the clinical symptoms of a bronchopneumonia appeared. It was only after 3 days

more that the neutrophils reached their highest number. At that time the complicating bronchopneumonia was nearing its end.



CASE 4 (CHART No. 23,842)

SUMMARY

The blood pictures of 35 influenza cases were examined during the epidemic between August and October, 1928.

The patients were all colored males.

By repeated differential counts under special consideration of the nuclear shifting of the neutrophils, the disease was followed in its course into the con-

valescent period. At the onset, the blood showed a normal or low percentage of the neutrophiles with a high relative number of the young forms ("nuclear shifting to the left") and satisfactory or slightly increased numbers of the lymphocytes. In uncomplicated cases there followed a return of the nuclear shifting to more normal numbers, with a moderate increase of the neutrophiles and corresponding decrease of the lymphocytes, which, during the convalescence, gave way to a short period of relative lymphocytosis. The mononuclears showed a tendency to increase when the temperature was at its height, whereas the eosinophiles were practically absent during the acute period of the infection.

The nuclear shifting appeared to be of special prognostic value, as there was a decrease in benign cases; a persistently high percentage in protracted cases; and a further increase indicated the oncoming of exhaustion, relapse or a complication, even when other clinical symptoms were lacking.

Regarding diagnostic significance, the differential count admits of a differentiation between acute diseases of the respiratory tract and chronic (clinical) malaria on the one side, and influenza on the other.

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4. Becker, *Zeitschrift fuer Tuberkulose*, July 1928, Nr. 51, quoted from *Jour. Amer. Med. Assocn.*, Vol. 91, No. 17

GROSS PATHOLOGY OF GASTRO-INTESTINAL TUBERCULOSIS

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Modes of Infection.—Primary tuberculous infections of the gastro-intestinal tract are encountered more frequently in children than in adults, and the primary infection is generally due to the Bovine type of bacilli.

In adults the lesions are generally secondary to tubercular foci in the pulmonary tissues, and the Bovine type is rarely found.

There are 3 possible modes of infection: (1) through the lymphatic system; (2) through the blood stream; and (3) by swallowing the tubercle bacillus.

In pulmonary tuberculosis with cavity formation we frequently encountered

tubercular lesions of the gastro-intestinal tract, and this indicates that the swallowing of sputum is the most frequent method of infection.

Special Findings from Experience.—Of 50 autopsies that I have performed in the past 2 years, 42 had pulmonary tuberculosis with cavity formation; and of these, 25 had tuberculous involvement of the gastro-intestinal tract. Two had general miliary tuberculosis, but no cavity formation was present in the lungs, and both cases had tuberculous involvement of the intestines. Of the 6 remaining cases, all were moderately advanced pulmonary tuberculosis, and no intestinal lesions were found.

These necropsies were performed on adult males of various races; and in 54% gastro-intestinal tuberculosis was noted.

The ileo-caecal region is involved earlier and more frequently than any other part of the alimentary tract. This is thought to be attributable to the greater abundance of lymphoid tissue and the delayed movement of the intestinal contents in that region.

The incidence and the location of tuberculous involvement in the gastro-intestinal tract was as follows:

Stomach	1	Duodenum	2
Jejunum	8	Ileo-caecal region	23
Appendix	3	Ascending colon	5
Transverse colon	2	Descending colon	2
Rectal fistula	2		

Development of Ulceration.—Primarily tuberculous enteritis begins as scattered projecting nodules, usually over solitary follicles or Peyer's patches. Unlike those of typhoid fever, the lesions may extend beyond these structures and involve indifferently the surrounding mucosa. The early tubercular lesions appear as slightly reddened nodules which break down and become ulcers. These ulcers most frequently extend laterally, but may reach out in any direction, coalesce, and infrequently encircle the whole gut. The margins of tuberculous ulcers are ragged, irregular, thickened and undermined. The base is covered with yellowish necrotic material, which is easily washed off and reveals characteristic tuberculous granulations.

In the 27 cases of gastro-intestinal tuberculosis, 25 had ulceration of the intestines. In 2 of these, perforation had occurred in the lower part of the ileum. In 30% of the cases the tubercular lesions in the intestines were in the process of healing.

In the 2 cases of general miliary tuberculosis, tubercular lesions were present in the intestines but had not reached the stage of ulceration.

When the ulcers are deep, the muscular and sub-serous layers contain tubercles. The serosa is thickened and granular, and there is some congestion of the blood vessels. The serosa is often adherent. Generally the lymph vessels leading away from ulcerative areas are swollen and granular, and are readily seen from both mucous and serous surfaces.

Many Complications Found.—Complications from tuberculous enteritis are numerous. In each of the 27 cases, the mesenteric lymph glands were involved and the distribution was fairly general. In 4 cases the glands were caseous, and in 1 of them a lymph node had shelled out and was free in the abdominal cavity.

In 8 cases not showing tuberculous lesions in the intestines, the mesenteric lymph nodes were involved.

Tuberculous peritonitis occurred in 13 cases, and in 9 of them adhesions were present.

When there is fluid in the peritoneal cavity, it is generally slightly cloudy, light straw-color, small in amount, and nearly always contains some fibrin. When a large amount of fluid is present, it is probably due to cirrhotic or amyloid changes in the liver, spleen or kidney; however, heart conditions may be responsible.

How the Ulcers Heal.—Healing of the ulcers takes place by granulation and cicatrization. The granulation tissue varies in depth from 2 to 5 mm. The mucosa covering the healed ulcer is thin. Healed ulcers and those beginning to heal were noted in 8 cases. When healing takes place there is more or less constriction of the intestine in that region, and the lumen may be partially or completely closed. In 1 case there was an intussusception in the middle portion of the ileum, with beginning gangrene. The ulcers were numerous in this region and the lumen of the intestine was small.

CONCLUSIONS

1. Tuberculosis of the gastro-intestinal tract is of more frequent occurrence in cases of pulmonary tuberculosis when there is cavity formation.

2. The lesions are more frequently encountered in the ileo-caecal region.

3. Tuberculosis of the mesenteric lymph nodes occurs in practically all cases of tuberculous enteritis. However, involvement of the lymph nodes may be present without a definite gross evidence of tuberculous enteritis.

CONDENSED SUMMARY OF THE LABORATORY WORK DONE IN TELA RAILROAD COMPANY HOSPITAL DURING 1928

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Examinations Made; Comparative Annual Figures.—Nothing of a spectacular nature has occurred during the year, although the prosaic routine has been interrupted frequently and the bulk of our work has exceeded that of any previous

year. For a comparison of the number of examinations conducted each year since 1922, the following figures are submitted:

Year	No. of Exami- nations
1922	10,395
1923	14,441
1924	17,088
1925	17,756
1926	20,712
1927	24,843
1928	28,223

Malaria Data for Five Years.—As is shown in our Consolidated Laboratory Report (page 362 of this Annual Report) these examinations include a variety of findings. Malaria continues to be the predominating malady in our Division and perhaps will occupy that position for some years to come. However, we are pleased to note that our records show 1928 as our year of lowest incidence for this disease. The following are our laboratory data on malaria for the past five years:

Year	No. of Speci- mens Exam- ined	EA %	T %	O %	Mixed Infec- tions %	Total Pos. %
1924	5,881	18.0	14.8	1.0	1.6	35.4
1925	5,754	23.0	7.0	0.78	1.5	32.28
1926	6,145	27.3	4.8	0.89	0.66	33.65
1927	8,780	27.9	6.4	0.57	0.6	35.47
1928	9,836	17.6	5.3	0.42	0.8	24.12

Difficulties of Compiling Malaria Data.—The above figures are not based on individual cases, as a large number of cases were repeatedly examined. Surgical cases admitted indicate that the percentage of positives approximate closely those admitted to the medical service.

Only by regular periodical surveys of the labor camps can we make a uniformly correct index of the malaria situation. But, so far, such a program has been rather impracticable, principally on account of the rapid turnover of labor in many of our camps. This has proved to be the chief obstacle in the proposed plan to survey the camps and treat positive cases there. In a camp of permanent dwellers, that plan would probably solve the malaria problem in this Division, but the difficulties are great unless labor can be stabilized.

Venereal Disease a Large Problem.—Venereal disease is another of our major problems, especially among the laboring class. Our records show an average of about 50 cases of venereal disease treated each month, of which more than 40% are syphilis. (We find the percentage slightly higher in men than in women.) The majority of these belong to a class who see little need for treatment further than that which is necessary to afford temporary relief. As a result, we have

to deal with a large number of old cases of syphilis which, of course, are very resistant to treatment.

It is interesting to note that from January, 1923, to April, 1926, inclusive, we made over 6,000 Wassermann tests in this Laboratory, with an average of 15.5% positive. In April, 1926, we discontinued the Wassermann test in favor of the Kahn, as we found the latter was slightly more sensitive and involved considerable less time and expense. From April, 1926, to December, 1928, inclusive, we made 8,435 Kahn tests and found 21.74% positives.

Results Obtained with Kahn Test; Syphilis.—The following records are of cases who have adhered closely to all prescribed treatment; the first 3 cases are syphilis of long standing; the other 3 cases applied promptly for treatment. The comparative results of the treatment of chronic and early cases are apparent, as revealed by the Kahn test in the cases recorded immediately below:

(a) Male, Jamaican, Aged 40 Years:

1926		
Sept. 27	+++	
Oct. 11	+++	
1927		
Jan. 22	++	
Feb. 15	+-	
Mch. 21	++	
April 6	++	
May 6	+-	
June 8	+-	
July 11	++	
Oct. 3	++	
1928		
May 31	+	
Aug. 14	++	
Oct. 6	+	
Dec. 26	+-	

(b) Male, Nicaraguan, Aged 31 Years:

1927		
Jan. 5	++	
Jan. 14	++	
Feb. 16	+	
Feb. 26	+	
Apr. 25	++	
June 1	++	
July 13	+	
Aug. 24	+	
Oct. 5	+	
1928		
Mch. 14	+	
May 26	++	
Oct. 6	-	

(c) Male, American, Aged 26 Years:

1926		
Aug. 16	++++	
Sept. 24	++++	
Oct. 16	++++	
Dec. 1	++	
1927		
Jan. 21	+	
Mch. 4	++	
May 24	++	
July 6	+-	
1928		
July 27	+	

(d) Female, Honduran, Aged 22 Years:

1927		
Oct. 9	-	
1928		
Apr. 4	++++	
May 5	++	
July 6	-	
July 23	-	
Sept. 28	-	

(e) Male, American, Aged 38 Years:

1927
Nov. 21 —

1928
Jan. 21 + + + + (chancre)
Mch. 3 +
Mch. 28 —
Dec. 12 —

(f) Male, American, Aged 38 Years:

1928
Oct. 9 + + + + (secondary rash)
Nov. 20 +
Dec. 29 —

Kahn and Wassermann Results Compared.—The following 3 cases show a comparison of the Kahn and Wassermann tests:

(g) Male, Honduran, Aged 50 Years:

Jan. 17, 1923, Wassermann, ++
Mch. 5, 1924 " +
Apr. 22, 1925 " —
Feb. 24, 1926 " —
Mch. 10, 1926 " —
June 23, 1926, Kahn test, ++
July 28, 1926 " " ++
Sept. 7, 1928 " " +

(h) Female, Honduran, Aged 22 Years:

Sept. 29, 1925, Wassermann, Anticomplementary
Oct. 6, 1925 " "
Apr. 6, 1927, Kahn test, + + + +
June 9, 1927 " " + + +
Feb. 21, 1928 " " +
May 3, 1928 " " —
Aug. 13, 1928 " " —
Oct. 1, 1928 " " —

*(i) Female, Spanish, Aged 16 years, Heavy Malarial Infection, Kahn Tests on Father and Mother Both Negative:

Apr. 21, 1926, Wassermann, ++
Apr. 21, 1926, Kahn test, —
Apr. 28, 1926 " " —
June 2, 1926 " " —
May 12, 1927 " " —

Kahn and Wassermann Tests; Yaws.—The following 3 records are of yaw cases:

(j) Male, American, Aged 38 Years:

July 2, 1923, Wassermann, ++
July 11, 1923 " ++
Dec. 16, 1925 " —
Aug. 23, 1926, Kahn test, ++
Sept. 29, 1926 " " +
Nov. 15, 1926 " " +

* In this case of severe malaria the Wassermann test was misleading.

Jan. 8, 1927	Kahn test	+
May 25, 1927	" "	-
Oct. 11, 1927	" "	-
Nov. 7, 1927	" "	-
June 3, 1928	" "	-

(k) Male, Honduran, Adult (Age Unknown):

May 22, 1923,	Wassermann,	++
July 16, 1927,	Kahn test,	+

(l) Male, Negro, Aged 34 Years:

Dec. 9, 1924,	Wassermann,	++
Nov. 7, 1928,	Kahn test,	++++

The Kahn Test on Cerebro-spinal Fluid.—The question has arisen repeatedly as to the value of the Kahn test on cerebro-spinal fluid. My experience has been very limited, but, with the exception of 2 or 3 cases, those that I have done have corresponded well with blood tests and with clinical symptoms. The exceptions I attribute to faulty technique and lack of experience. I know that in 2 of these cases I used an old solution of ammonium sulphate which was perhaps not well saturated. Since these experiences I have prepared this solution fresh for each test and my results have been most satisfactory. The ammonium sulphate solution must be saturated and fresh. The following records show some of my results:

(a) Jan. 6, 1926,	Wassermann,	Spinal fluid,	++
Jan. 6, 1926	" "	Blood	++
Mch. 3, 1926	" "	"	++
June 30, 1926,	Kahn test,	Spinal fluid,	+-
June 30, 1926	" "	Blood	++
(b) Feb. 23, 1927,	Kahn test,	Blood,	++
Feb. 23, 1927	" "	Spinal fluid,	+-
(c) June 9, 1927,	Kahn test,	Blood,	++
June 9, 1927	" "	Spinal fluid,	++
(d) June 26, 1927,	Kahn test,	Blood,	++
June 26, 1927	" "	Spinal fluid,	+-
(e) Oct. 2, 1928,	Kahn test,	Spinal fluid,	+++
Oct. 6, 1928	" "	Blood,	++

I hope to be able to do a greater number of these tests in the future, but at present I believe that the Kahn test on cerebro-spinal fluid is reliable.

We have not yet been confronted by anything alarming in the way of any epidemic. Occasionally a mild outbreak of some infectious disease occurs, but subsides rapidly.

Bacillary Dysentery.—During May and June of this year we came in contact with an unusually large number of cases of bacillary dysentery, which indeed

threatened to become serious. However, this outbreak subsided promptly with only 3 or 4 fatalities. The cases originated in widely separated localities and could not be traced to any particular area nor source of infection.

Diphtheria.—Cases of diphtheria also occurred this year and threatened epidemicity. The cases have been remarkably mild and, with the exception of about 3 cases, only the slightest symptoms have been experienced. It seems that the natives of this country possess a great degree of immunity to diphtheria; and, while foreigners residing here are susceptible, they usually experience only the mildest symptoms. This we attribute largely to climatic conditions and semi-outdoor living.

It was not until January, 1927, that we came in contact with our first genuine case of diphtheria. At once a limited survey was made and 4 carriers were found. The fact created no alarm, but proved the incentive to further investigation and constant alertness. The following data covering cases found are submitted:

	1927	1928
January	5	—
February	—	—
March	—	—
April	—	—
May	—	—
June	—	1
July	1	—
August	2	3
September	—	1
October	—	22
November	1	1
December	1	1
Totals	10	29

Typhoid Fever.—From year to year a few cases of typhoid are treated. There is no well defined focus of infection, but occasional cases occurring sporadically throughout the Division. We find an average of less than 1 case per month. The cases are usually severe in nature but in no instance has the disease assumed epidemic proportions.

Although sufficient typhoid vaccine is always kept on hand to vaccinate the inhabitants of any typhoid infested area should conditions demand it, so far we have had no occasion to make general use of it. The people of the community are periodically informed that the vaccine is on hand, and that all who wish may be vaccinated, but few take advantage of the opportunity.

Tuberculosis.—This disease ranks high in percentage on our list of fatal diseases. During the past 2 years we have had an average of about 7 cases per month. We know that the living conditions of the native population are more or less favorable to the spread of this disease, and also that not much can be

done to remedy those conditions. The turnover of labor is very rapid; the attempt to educate the laborer against the spread of any disease is most discouraging; and, as has been stated in previous reports by Dr. Clark, most of the cases of tuberculosis coming to our attention originate in neighboring towns outside the Division.

Intestinal Parasites.—Infestations with intestinal parasites are common in the Tropics, and usually prove very detrimental to health. Cases applying at the hospitals and dispensaries receive treatment routinely, but the prevention of reinfestation is a very difficult problem. In 5,587 stool examinations 207 were found positive for *Entamoeba histolytica*. The following parasites were also found:* hookworm, 32.48 %; ascaris, 38.9%; tape worm, 0.59%; *Balantidium coli*, 0.41%.

Autopsies.—Our autopsies (28) were confined more or less to cases of special interest and to those in which the cause of death was not otherwise clearly defined.

POST-MORTEM SUMMARY, WITH COMMENTS ON SOME OF THE MOST INTERESTING FEATURES

WALTHER JANTZEN, M.D.

Truxillo Railroad Company Hospital

Puerto Castilla, Honduras

PRELIMINARY REMARKS

During the year 1928, 118 deaths occurred in this Hospital and 77 autopsies were performed, of which 24 were on patients who died from lobar pneumonia. The inflammatory process involved more than one lobe, as a rule, and complications such as empyema, abscess, purulent or exudative pericarditis or nephritis were of frequent occurrence. An enormous spleen was found in two instances. Pneumococcic infections of the meninges were recorded 5 times as the cause of death; in a 6th case with meningitis the organism which caused the disease could not be identified, as the body was embalmed before the autopsy was performed.

Tuberculosis of the lungs, of subacute or chronic character and of more or less extensive involvement, was revealed several times through the autopsies as incidental findings. In three cases it was the cause of death: The 1st was a case of acute disseminating tuberculosis with heavy involvement about the hilus of both lungs and also retroperitoneal glands; the 2nd was a case of tuberculous meningitis; the 3rd was an acute tuberculosis of the lungs.

* Only the most important are mentioned.

Bronchopneumonia was found several times. Twice it was apparently the cause of death. Eight cases of septicaemia were autopsied. Among the causes were infection after premature childbirth; pyogenic infection of the skin and purulent myositis in the muscles of the leg. Twice we found streptococcic endocarditis. One case was complicated with contracted kidneys, hypertrophy of the heart, and an active tuberculosis in the apex of the right lung.

Malaria was twice recorded as the cause of death; haemoglobinuric fever and its sequelae were seen 4 times. Various degrees of enlargement of the spleen were frequently present, and malarial pigment was found in smears from the spleen and bone marrow in a high percentage of other cases, indicating a chronic malaria infection.

Degeneration of the heart muscle and myocarditis were twice the cause of death. Cardiovascular syphilis was found 3 times: 2 cases in West-Indian negroes, 40 and 60 years of age, respectively, and 1 in a Honduranian 45 years of age. In only 1 case was it the apparent cause of death.

An amoebic abscess of the liver was found once; dysenteric sequelae acute or chronic in character in the large intestines were extremely rare.

Eclampsia during childbirth caused the death of 1 patient.

Mastoiditis was found in one baby of 7 months as the cause of death.

Cysticercus of the brain and pectoral muscles was seen once.

Acute nephritis, for the most part toxic in character, was found several times in connection with acute diseases, but rarely as the cause of death. One autopsy revealed a great white kidney and hypertrophy of the heart; the patient died from a gunshot wound of the arm. One case of septicaemia was complicated with contracted kidneys and hypertrophy of the heart. One patient died of uraemia with acute nephritis after haemoglobinuric fever. Pyelitis with prostatic hypertrophy and periurethral abscess was recorded as the cause of death in one case.

One patient died of primary carcinoma¹ of the liver, which was also sclerosed in places; another died of lymphoblastoma¹ in the pelvis, which involved the sciatic nerve and the sacral plexus, and metastases were present in the heart and kidneys.

Appendicitis with peritonitis was the cause of death in 3 cases.

Five deaths from gunshot wounds were autopsied. More or less extensive lesions of the abdominal viscera or bones were present. In 1 case a chronic nephritis with hypertrophy of the heart, and in another case a bronchopneumonia, decided the issue. Two deaths from machete wounds were autopsied. In 1 case both hands and also parts of the forearm were missing and there was a penetrating wound of the skull; in another case a meningitis had followed a lesion of the skull.

An extensive necrosis of liver cells,¹ extending from the central veins almost to the periphery of every lobule, was found in another case. The patient was sick for 10 days with irregular fever. The blood film showed E. A. rings;

the spleen weighed 1,150 grams. The patient was treated with daily doses of 0.09 gm. of plasmochin and 2 gms. of quinine for 3 days; 30 min. of chenopodium and 20 min. of carbontetrachloride were given.

Seven cases showed rather interesting features, although an accurate diagnosis could not be made. All cases showed symptoms of destruction of the red-blood cells with marked anaemia. The following data show the clinical symptoms and the autopsy findings in 6 of these cases.

CASE 1

History.—J. O., Latin-American, male, aged 41 years. Sick, with pain in spleen and liver, and with jaundice, for 9 days before entering this Hospital; 1 gm. of quinine taken in camp. On admission (6-12-28), liver, spleen and kidney region very tender; marked jaundice; temperature, pulse and respiration, normal; urine, albumin trace, bile positive, some hyaline casts; stool, uncinaria ova; blood, negative for syphilis and malaria.

Treatment.—Over a period of 10 days he received daily 0.045 gm. of plasmo-chin compound and 20 gms. of quinine; and 1 treatment of chenopodium 30 min. with carbontetrachloride 20 min. The temperature always remained normal. On June 20, 1928, the leukocytes were 8,400; lymphocytes 20%; large mononuclears 4%; neutrophils 74%; eosinophiles 2%. Death occurred 12 days after admission.

Autopsy.—Well-developed and well-nourished body, but jaundiced; marked dilatation of heart (310 gms.). Spleen hard (700 gms.). Liver (1,900 gms.) of very dark color. Kidneys (475 gms.) swollen and chocolate-colored. Urine: haemoglobin negative, albumin and bile trace. Van der Bergh test of serum instantaneously positive (direct and indirect methods). *Microscopically:*² Much haemosiderin in liver cells and endothelial cells of liver. Liver cells in general showed marked degeneration; there was irregular central necrosis of liver cells to an extensive degree. There was also a marked degree of degeneration of epithelial cells of the convoluted tubules of both kidneys with deposits of very finely granulated haemosiderin. No malarial pigment, and no malaria parasites were found.

CASE 2

History.—E. A., Latin-American, male, aged 34 years. Sick about 1 month, with fever, and pains general over the body. There was slight jaundice. He had taken no quinine in camp. On admission (6-16-28) examination showed a poorly nourished male with bad teeth and slight jaundice; spleen enlarged to umbilicus, liver margin 2 fingers below costal margin; urine, bilirubin positive, albumin trace, few casts; stool, uncinaria ova, blood, and pus; blood, erythr. 1,420,000, hb. 70%, leukocytes 3,000, lymphocytes 35%, polynucl. 65%, eosin. 1%, basoph. 1%, normoblasts 2%, anisocytosis, poikilocytosis, few E. A. ring forms, syphilis test negative.

Treatment.—0.045 gm. plasmochin compound daily for 6 days, and 2 gms. quinine daily for 16 days. Neosalvarsan, 0.6 gm., was given intravenously, followed by Fowler's solution; chenopodium 30 min., carbontetrachloride 20 min., were also administered. There was practically no fever.

Autopsy.—Poorly nourished, slightly jaundiced body. Slight dilatation of heart. Spleen 2,600 gms., liver 2,400 gms., both organs being very dark in color. There were large areas of hard white tissue in the spleen (old infarcts). The gall bladder contained stones. There were superficial ulcerations and coagulation necrosis of the mucous membranes of large intestines, but no amoebae nor *Balantidium coli* were found. Kidneys swollen and of chocolate color. Urine: Bilirubin positive, haemoglobin negative. *Microscopically:*² Same as Case 1, but epithelial cells of convoluted tubules of kidneys showed a more extensive degeneration.

CASE 3

History.—R. L., Latin-American, aged 25 years. Sick about 8 days with fever, chills and nausea, and pains over whole body. Three tablets (1 gm.) of quinine given in camp. On admission (6-19-28), marked jaundice; heart slightly enlarged; spleen enlarged 3 fingers below costal margin; liver tender and enlarged; bronchial râles over both lungs; stool, uncinaria ova; urine, negative; blood, negative for malaria.

Treatment.—Plasmochin compound 0.015 gm.; quinine 3 gms.; mercurochrome intravenously; and ephedrine. Irregular temperature up to 102°. Died 2 days after admission.

Autopsy.—Heart weighed 300 gms. Few consolidated patches in both lungs. Spleen 1,000 gms. and liver 2,400 gms.; both dark in color. Kidneys (500 gms.) swollen and of chocolate color. Urine, negative for haemoglobin; no microscopic examination made.

CASE 4

History.—M. R., Latin-American, aged 50 years. Ill about 40 days previous to admission, with fever and headache. Took quinine for 7 days. On admission (2-2-28), no fever, very anaemic, and badly nourished; spleen and liver tender; urine: trace of albumin and few hyaline casts, Diazo negative; blood: red cells 500,000; leukocytes 9,000; lymphocytes and mononuclears 33%; neutrophils 67%; microcytes, erythroblasts, normoblasts; poikilocytosis and anisocytosis; hgb. 40%; syphilis test negative; stool negative.

Treatment.—0.03 gm. plasmochin compound daily for 3 days. Died 4 days after admission.

Autopsy.—Heart dilated (300 gms.), tigroid striation of muscle. Spleen (225 gms.) indurated. Urine: Diazo negative; albumin, sugar and bile negative; pus and urobilin positive. Bone marrow dark red. *Microscopically:*¹ Haemosiderin, erythroblasts and normoblasts in spleen. Liver: marked deposit of haemosiderin in liver cells. Haemofuscin and a little haemosiderin in fibroblasts

around the large blood vessels. Necrosis of liver cells in the centers of the lobules, with infiltration by polymorphonuclear and endothelial leukocytes, and phagocytosis of necrotic cells and pigments by endothelial leukocytes. No evidence of cirrhosis.

CASE 5

History.—M. H., Latin American, male, aged 23 years. On admission, examination (4-29-28) showed him to be very anaemic, with heart enlarged and systolic murmurs. Blood, few E. A. rings, hgb. 30%, erythrocytes 900,000; leukocytes 10,400, neutrophils 38%; lymphocytes 54%, mononuclears 8%, normoblasts 14%. Anisocytosis and poikilocytosis were present. Syphilis test negative. Urine negative for albumin and sediment; stool, uncinaria ova.

Treatment.—Plasmochin .06 gm. and quinine 2 gms. daily for 5 days, then plasmochin 0.045 gm. and quinine 2 gms. for 2 days. Mercurochrome 1% 25 cc. intravenously. Irregular temperatures from 99° to 104°. Died 9 days after admission.

Autopsy.—Poorly developed and poorly nourished body. Slight jaundice. All organs extremely pale. Heart (300 gms.) dilated. Spleen soft (1,100 gms.). Liver (2,250 gms.) showed dark red patches on surface. Kidneys, 300 gms. Many superficial ulcerations with grayish membranes on mucous membrane of caecum and descending colon. Bone marrow dark red. No microscopical examination.

CASE 6

History.—V. S., Latin-American, aged 19 years. Entered Hospital for treatment of severe pain in right arm and leg which began on day of admission. Examination showed poorly nourished and very anaemic patient; heart dilated; spleen 3 fingers below costal margin. Pains became so severe that morphine was required. Blood: Hgb. 30%; erythrocytes 900,000; leukocytes 20,000; polynuclears 49%; lymphocytes 36%; mononuclears 15%; normoblasts 12%; megaloblasts 3%; marked anisocytosis, poikilocytosis and polychromatophilia; few tertian parasites. Urine: Albumin trace; urobilin and Diazo negative; urobilinogen strongly positive. Stool, uncinaria ova.

Treatment.—Narcotic to relieve pain; quinine, 12 gms. was given within 5 days with plasmochin .04 gm. for 3 days and .02 gm. once on the 4th day. Irregular temperature up to 104°. Died 6 days after admission.

Autopsy.—Heart 275 gms., dilated. Spleen, 725 gms., very dark. Liver (1,950 gms.) showed nutmeg appearance. Kidneys, 250 gms. Bone marrow, dark red. Brain, very oedematous and with very many minute haemorrhages in both hemispheres. No microscopical examination.

COMMENTS

This report shows in general the same features as those of the foregoing years. The percentage of pneumonia among our autopsies was lower this time,—only

about one-third this year as against one-half during 1927. Nevertheless, lobar pneumonia is still the principal cause of deaths in our Hospital. Complications and involvement of great areas of lung tissue were frequently present. This and the rather frequent infection of the meninges with pneumococci demonstrate again the low resistance of the Latin-American race in tropical countries to pneumococcal infections.

Individuals who died from tuberculosis were, as a rule, not autopsied; therefore the figures in this report do not give a correct impression of the incidence of this disease. Tuberculosis of the lungs was more frequently encountered this year than last, probably on account of the unusually long rainy season.

Intestinal changes resulting from amoebic dysentery were few, owing to the comparatively infrequent incidence of the disease in this Division.

A definite diagnosis concerning the cause of death in the 6 cases reported in detail can not be given. The acute destruction of the blood, the central necrosis of the liver lobules, and in 3 cases a degeneration of the kidneys, are characteristic features. In the first 3 cases the chocolate color of the kidneys resembled the kidneys of haemoglobinuric fever, but on microscopic examination no casts of haemoglobin were found and no haemoglobin was present in the urine. The spleen was much enlarged in 5 of these cases. Haemosiderin was present in rather large amount in the liver, and in the kidneys in 2 cases. A severe ulcerative colitis was associated with these symptoms in 2 cases, amoebae not being found. Apparently the profound anaemia was not caused nor influenced by the drugs given, as it was present in all cases upon admission.*

*EDITOR'S NOTE: On the other hand owing to the general anaemia and consequent low degree of resistance, the toxic drugs administered may have contributed to the lethal termination. Under normal conditions, however, and in the dosage given, no serious results should have followed the administration of these drugs.

1. Microscopical Examination, Dr. F. B. Mallory, Boston, Mass.
2. Dr. R. Hoeppli, Tropical Institute, Hamburg

AN EXTENSIVE ELECTRIC BURN

R. B. NUTTER, M.D.

Tela Railroad Company Hospital

Tela, Honduras

A boy, fifteen years old, at play climbed a telephone and power wire pole and fell directly across two phases of a 4,600-volt, 60-cycle circuit. The circuit was



FIG. 1

broken by the automatic switch in the power plant, but an attendant in the plant, not realizing what had occurred, threw in the switch and gave the boy a second shock. Automatically, the switch opened again and investigation was made as to the cause of the short-circuit. The patient survived, but suffered severe burns on back and right arm, as shown in the above photograph. The condition of the patient at the time he was discharged from the Hospital is shown in Fig. 2, page 270.



FIG. 2. CONDITION OF THE PATIENT AT THE TIME HE WAS DISCHARGED FROM THE HOSPITAL

AN OUTBREAK OF FOOD POISONING

R. B. NUTTER, M.D.

Tela Railroad Company Hospital

Tela, Honduras

On October 13, 1928, about 150 cases of food poisoning occurred in the village of Tela and in the district of San Alejo. In addition, several more cases developed in Old Tela that were treated by local physicians. Puerto Cortes, San Pedro, and the towns along the National Railroad reported similar outbreaks.

A shipment of native cheese had been made to a Syrian provision dealer and distributed by peddlers in Tela and San Alejo. Shortly after eating the cheese, the victims were seized with severe abdominal pains, diarrhoea, vomiting, and in some instances marked prostration. Six cases were admitted to the Hospital; the others were treated in their homes. Among those treated by members of our Medical Staff there were no fatalities. A specimen of the cheese was examined in the Tela Hospital Laboratory and found to contain:

B. botulinus
B. coli
Staphylococci
Streptococci

It is interesting to note that two individuals who partook of the cheese after it was toasted, did not develop symptoms.

ABSTRACTS OF SNAKE-BITE CASES

CENTRAL AMERICAN DIVISIONS—UNITED FRUIT COMPANY

1928

H. C. CLARK, M.D.

Medical Department, United Fruit Company

It is exceedingly difficult to secure reliable and complete information on the number and character of these accidents. Many times it is impossible to obtain from the patient or his companions a satisfactory knowledge of the snake and the circumstances surrounding the case. The labor forces should frequently have impressed on them that it is important to capture the snake, in order that the species may be determined as well as to know the probable quantity of venom that has been injected. If a snake is empty, it is strong circumstantial evidence that the amount of venom injected was large, while if a recently ingested

meal is found it is equally strong evidence that a small quantity of venom was injected. Furthermore, for scientific purposes it is desirable to obtain all the evidence possible on the nature of the type of food consumed by the various species of poison snakes.

During 1928 a number of snake-bite cases have occurred in the plantations of the United Fruit Company which are located in the coastal plains of Central America. Some of the cases are well recorded while others are recorded in a fragmentary manner or data have been entirely omitted. It is, nevertheless, important to file what information we do possess. In accordance with this idea, the following abstracts of case histories are presented.

TELA RAILROAD COMPANY

CASE 1

Case History No. 12720.—This accident occurred at 9 A.M., Feb. 9, 1928 on Farm No. 26 of the Guaymas District.

First Aid Treatment: Admitted at 6 P.M. (9 hours after the accident) and was given an intramuscular injection of antiophidic serum. February 10th, at 8 A.M., an intravenous injection of 1 ampoule of antiothropic serum was administered.

Other Treatment Employed: Magnesium sulphate, morphine and alkalies. Salt solution was given by hypodermoclysis.

History of the Accident: The snake struck the base of the right thumb on the dorsal surface.

Symptoms: Complained of pain in the right arm soon after the accident. Expectorated a small amount of blood-stained saliva.

February 10th—Still expectorated some bloody saliva.

February 11th—Bloody expectoration had ceased. The swelling of the right arm had extended into the pectoral region. There was an annular discoloration of the thumb and index finger. Toward evening he became delirious and had difficulty in speaking.

February 12th—Delirium continued; patient was unable to articulate, and had difficulty in swallowing. Nystagmus was present; there was muscular twitching of the right side of the face; and the right pupil was dilated.

February 13th—Restless and had a sighing type of respiration.

Physical Examination: Oozing of blood from the gums. Blood pressure 125/70. The right hand was greatly swollen. An incision about one inch long was present over the dorsal surface of the base of the right thumb. A tourniquet was found loosely applied about the lower end of the right forearm. The entire arm was swollen to the level of the shoulder. The arm was painful throughout the swollen area. There were numerous blebs on the anterior surface of the arm.

Laboratory Reports: Blood films (3) were negative for malaria; urine, albumin and casts were present; stool, ova of the hookworm and round-worm were found.

Chart: Temperature, ranged from 100.5 to 102; pulse, ranged from 88 to 104; respiration, ranged from 24 to 30. The patient died at 8 A.M. February 14th.

Post Mortem Findings: (1) Gangrene of first three fingers of right hand; (2) lungs showed soft haemorrhagic areas at base; (3) brain: small meningeal haemorrhages over the cortex and base. A lemon-sized blood clot was present in the tip of one temporal lobe. The lateral ventricles contained blood-stained fluid.

CASE 2

Case History No. 14243.—This accident occurred at 9 A.M., June 18, 1928 on Farm No. 38 of Guaymas District.

First Aid Treatment: Incision of the wound.

Hospital Admission: Midnight of June 18th (15 hours after the accident). One ampoule of antiothropic antivenin was given on the way to the hospital.

Other Treatment Used: Salts, quinine and plasmochin.

History of Accident: While at work on the farm he was bitten on the left little toe. The snake responsible was a "barba amarilla" (*B. atrox*). It is not known whether or not the snake had an empty alimentary tract.

Symptoms: None.

Physical Examination: Left foot was swollen and tender.

Duration of Stay in Hospital: Two days.

Result on Discharge: Cured.

CASE 3

Case History No. 14515.—This accident occurred at the Lancetilla Experiment Station, on July 4, 1928.

First Aid: Incision at site of bite.

Hospital Admission: 6:15 P.M., on July 4th. No antivenin was given.

Other Treatment Used: Incision of the wound; application of heat to the wound; strychnine and veronal given.

History of Accident: While at work on the farm the patient was bitten by an unidentified snake. It was about two feet long. The location of the bite was at the base of the distal phalanx of the left middle finger. The snake appeared to be empty.

Symptoms: Moderate swelling of the left hand.

Physical Examination: Small incision at the site of the bite.

Duration of Hospital Stay: Twenty-four hours.

Result on Discharge: Cured.

CASE 4

Case History No. 15064.—This accident occurred at 7 A.M., Aug. 2, 1928, on Farm No. 31, in the Guaymas District.

First Aid: Iodine painted over the wound.

Hospital Admission: Admitted at 3 A.M., Aug. 3, 1928 (20 hours after the accident). One ampoule of antiothropic serum was given one hour after the accident.

Other Treatment Used: Salts.

History of Accident: While at work in the bush, the victim was bitten on the right hand by a small green snake. The snake had no visible lump in its body.

Symptoms: None.

Physical Examination: Negative.

Duration of Stay in Hospital: Three days.

Result on Discharge: Cured.

CASE 5

Case History No. 15268.—This accident occurred at 9 A.M., Aug. 16, 1928, on Farm No. 20 of the Guaymas District.

First Aid: One ampoule of antiothropic serum was administered very soon after the accident. The wound was incised.

Hospital Admission: 2:30 P.M., Aug. 16, 1928, 6 hours after the accident, a second dose of the same serum was given.

Other Treatment Used: Hot water bag, salts and quinine.

History of the Accident: While at work in the field a three-foot "barba amarilla" (*B. atrox*) struck the side of his left little finger. He was unable to state whether the snake had a lump of food in its body.

Symptoms: Felt exhausted and sleepy, and was spitting blood. These symptoms soon disappeared.

Physical Examination: Semiconscious; small wound on lateral surface of left little finger; left arm swollen and hot; slight bleeding from mucous membranes.

Duration of Stay in Hospital: Six days.

Result on Discharge: Cured.

CASE 6

Case History No. 16300.—This accident occurred at 9 A.M., Aug. 30, 1928, on Farm 35 of the Guaymas District.

First Aid: One dose of antiotheric serum was given just after he was bitten.

Hospital Admission: 5 P.M., Aug. 30, 1928. No further use of serum was indicated.

Other Treatment Used: Salts. Cold applications to wound.

History of Accident: While he was cutting bush he was bitten by a three-foot "barba amarilla" (*B. atrox*). The snake struck the base of the left index finger. It is not known whether there was a food lump in the snake's body.

Symptoms: Swelling of the left hand.

Physical Examination: Small wound at the base of the left index finger. The left hand was swollen.

Duration of Stay in Hospital: Five days.

Result on Discharge: Cured.

CASE 7

Case History No. 16853.—The accident happened at 8 A.M., Dec. 12th, 1928, on Farm 27, in the Guaymas District.

First Aid: Tourniquet was applied.

Hospital Admission: 3:35 P.M., Dec. 13, 1928 (31 hrs. and 35 minutes after the accident). No antivenin was given the case.

Other Treatment Used: Calomel and salts; cold applications to the wound.

History of the Accident: A small yellow snake bit him on the right shoulder (deltoid region). Nothing more is known about the snake. [It seems probable that it was a *B. schlegelii*.]

Symptoms: The right shoulder was swollen and there was numbness of the hand and arm, which was probably due to a tourniquet applied about the shoulder.

Duration of Stay in Hospital: Six days.

Result on Discharge: Cured.

It is noteworthy that six of the seven cases occurred in the Guaymas District and that four of the accidents were in July and August. The original snake census taken in this division revealed the fact that the fer-de-lance (*B. atrox*) rate was higher in this district than in any of the other four districts.

TRUXILLO RAILROAD COMPANY

CASE 1

Date, Place, and History of Accident.—Honduran, male, laborer, aged 27 years, was bitten at about 7:00 A.M., April 10, 1928, on Guabul Farm, in the Black River District. He was cutting underbrush, when the snake struck him on the left wrist. The patient described the snake as about 3 feet long, and stated that he believed it was a "barba amarilla" (*Bothrops atrox*).

First Aid Treatment.—No tourniquet was applied to the arm, nor was any other treatment administered until the patient reached the Hospital, 15 hours after the accident.

Hospital Admission.—10:00 A.M., April 10, 1928.

Symptoms.—The patient stated that his left hand and arm began to swell at once, and half an hour later he began to spit blood. He did not notice any other subjective symptoms.

Physical Examination.—Patient was well developed and nourished, and was not acutely ill. The pulse was of good quality, and the respirations were normal. The left hand, forearm and arm were markedly swollen, but not painful. No fang marks or other breaks in the skin could be found on the radial side of the flexor surface of the left wrist where the patient claimed that the snake bit him. No petechia or discolorations of the skin were observed.

Treatment Given.—Immediately on admission 1 ampoule of antithropeic serum was administered. Ice caps were applied, and magnesium sulphate and codein sulphate were given by mouth. On the following day the swelling had extended upward and involved the left shoulder. The patient now complained of a painful pricking sensation in the region of the bite. On the second day the swelling began to subside and on the seventh day it was entirely gone. There was never any blood in the urine and no blood was expectorated after the administration of the serum.

Duration of Stay in Hospital.—The patient was discharged as cured on April 19, 1928.

CASE 2

Date, Place, and History of Accident.—Nicaraguan, male, laborer, aged 26 years, was bitten at about 6:00 A.M., November 8, 1928, on Guabul Farm, in the Black River District. He was cutting underbrush, when the snake struck him on the index finger of the left hand. The snake was killed and sent to Dr. Thomas Barbour, of Harvard University who reported "This snake is perfectly harmless, and is known as *Xenodon colubrinus*."

First Aid Treatment.—The patient sucked the wound and spit out considerable blood for about thirty minutes after the accident. At about 7:00 A.M., a friend applied some native herb preparation to the finger, gave him about six ounces of aguardiente (native rum) to drink, and applied a tight bandage around his left wrist.

Hospital Admission.—8:15 P.M., November 8, 1928.

Symptoms.—The patient stated that subsequent to the accident he did not feel weak, dizzy nor nauseated. His vision was not impaired, nor did he experience any bleeding from the mouth or nose. There was a tingling sensation in the index finger and his hand felt somewhat swollen, but he continued to work for about one hour after he was bitten.

Physical Examination.—This was made in the hospital about fourteen and one half hours after the accident. The patient was a moderately well developed and nourished native, and apparently not very ill. On the left index finger just behind the nail there was a small superficial puncture wound which was not bleeding. The left hand and forearm were very slightly swollen. A tourniquet was on the wrist but the arterial circulation to the hand was not occluded. No petechial haemorrhages were found in the skin. The pulse was of good quality and respirations were normal.

Treatment Given.—Upon arrival at the hospital the patient was given one ampoule of antithropeic serum, the wound was cleaned and dressed, and magnesium sulphate was given by mouth.

Duration of Stay in Hospital.—On November 10th, the swelling and other symptoms had disappeared, and the patient was discharged on November 11, 1928.

CASE 3

Date, Place, and History of Accident.—Honduran, male, laborer, aged 38 years, was bitten at about 4:00 P.M., December 11, 1928, on Lerida Farm, in the Cuaca District. He was cutting underbrush, when the snake struck him on the right wrist. He did not see the snake.

First Aid Treatment.—About thirty minutes after the accident the patient was given eight ounces of whisky. A tourniquet was applied, but was not tight enough to cut off arterial circulation.

Hospital Admission.—7:30 P.M., December 11, 1928.

Symptoms.—The patient stated that almost immediately after he was bitten he became very dizzy and sick. He could scarcely see, and everything looked black for about ten minutes. He did not vomit nor spit any blood.

Physical Examination.—This was made in the hospital three and one half hours after the accident. The patient was a moderately well developed and nourished native. The right hand and forearm were moderately swollen, and on the radial surface of the right wrist there were two superficial puncture wounds in the skin about twelve millimeters apart. There were several small petechial haemorrhages on the right forearm. Haemoglobinuria and other forms of haemorrhage were not observed at any time during the course of the illness. Vomiting was absent, and the pulse was of good quality.

Treatment Given.—On admission to the hospital the tourniquet was removed and one ampoule of antiotheric serum was given. The small wounds on the wrist were cleaned and dressed, ice caps were applied, and magnesium sulphate and codeine sulphate were given by mouth. At this time the patient said that he felt slightly drunk and experienced a tingling sensation in the entire right arm. The patient never complained of any pain at the site of the injection of the antivenin. On the second day the swelling of the arm was nearly all gone.

Duration of Stay in Hospital.—The patient was entirely free of symptoms on December 15, 1928, and was discharged.

GUATEMALA DIVISION

CASE 1

Case History No. 48.

Date, Place, and History of Accident.—L. A., a laborer, was bitten at about 4 P.M., January 3, 1928, on Navajo Farm, in the Los Andes District. He was cutting grass, when the snake struck him on his right forearm. The patient could give no information concerning the size or species of the snake.

First Aid Treatment.—None recorded.

Hospital Admission.—4 A.M., January 5, 1928.

Symptoms.—There were no symptoms during the first half hour after the accident; but at the time of hospital admission (36 hours later) there was bleeding of the gums, and the hand and arm were swollen.

Treatment Given.—Immediately on admission 1 ampoule (10 cc.) of Brazilian "Soro Anti-Ophidico" antivenin serum was administered; and subsequently ice-caps were applied to the hand and arm.

Duration of Stay in Hospital.—The patient was discharged on January 12, 1928, in good condition.

CASE 2

Case History No. 451.

Date, Place, and History of Accident.—B. A., a laborer was bitten at 11 A.M., February 26, 1928, on Yuna Farm, in the Motagua District. He was cutting grass when the snake struck him on his left middle finger. The species of snake was not identified.

First Aid Treatment.—None recorded.

Hospital Admission.—11:30 A.M., February 27, 1928.

Symptoms.—There were no immediate symptoms, but later the left hand became swollen.

Treatment Given.—Immediately on admission 1 ampoule (10 cc.) of Brazilian "Soro Anti-Ophidico" antivenin serum was administered; hotwater bottles were applied locally; and the patient was wrapped in blankets to induce profuse perspiration.

Duration of Stay in Hospital.—The patient was discharged on March 4, 1928, in good condition.

CASE 3

Case History No. 559.

Date, Place, and History of Accident.—C. D., was bitten at 6:00 A.M., March 11, 1928, while walking on Navajo Farm 9, in the Los Andes District. A snake struck him on the left foot, but no information concerning the species of snake was obtainable.

First Aid Treatment.—None recorded.

Hospital Admission.—12:30 P.M., March 11, 1928.

Symptoms.—There were no immediate symptoms; but later the foot became swollen, and the foot at the site of the injury and the gums of the teeth bled considerably.

Treatment Given.—Immediately on admission 1 ampoule (10 cc.) of antivenin serum was administered, and ice-bags were applied to the foot.

Duration of Stay in Hospital.—The patient was discharged on March 23, 1928, in good condition.

CASE 4

Case History No. 805.

Date, Place, and History of Accident.—C. C., laborer was bitten on the morning of April 15, 1928, at Gualan, Guatemala. He was cutting grass when a snake struck him on the third finger of the left hand. The species of snake was not identified.

First Aid Treatment.—None recorded.

Hospital Admission.—11:30 A.M., April 15, 1928

Symptoms.—The hand was swollen, and there was bleeding of the gums.

Treatment Given.—Immediately on admission, 1 ampoule (10 cc.) of Brazilian "Soro Anti-Ophidico" antivenin serum was administered, and dressings were applied to the wound.

Duration of Stay in Hospital.—The patient was discharged on April 18, 1928, in good condition.

CASE 5

Case History No. 1019.

Date, Place, and History of Accident.—E. M., was bitten at 11:00 A.M., May 8, 1928, on Chinook Farm. He was walking when the snake struck him on the third toe of the left foot. The species of the snake was not ascertained.

First Aid Treatment.—None recorded.

Hospital Admission.—1:30 P.M., May 8, 1928.

Symptoms.—No symptoms developed immediately, but subsequently the foot became slightly swollen.

Treatment Given.—Immediately on admission 1 ampoule (10 cc.) of Brazilian "Soro Anti-Ophidico" antivenin serum was administered, and ice-bags were applied to the swollen area.

Duration of Stay in Hospital.—The patient was discharged on May 16, 1928, in good condition.

CASE 6

Case History No. 1177.

The accident happened at 10 A.M., May 24, 1928, on Onondaga Farm, in the Bobos District.

First Aid: Polyvalent antiophidic serum from Butantan was used at the Field Dispensary, 4 hours after the accident.

Hospital Admission: 12:30 P.M., May 25, 1928. A second dose of antivenin was given at the time of admission to the hospital.

Other Treatment Used: Cold application to the wounded area.

History of the Accident: He was working on the farm when a snake bit him on the back of the left ring finger. It was apparently an empty snake. The snake was sent to Dr. Thomas Barbour for identification. The species has not yet been reported.

Symptoms: No symptoms during the first half hour; then there was bleeding of the gums and haematemesis. The hand and arm became swollen. Epistaxis occurred at 3:30 P.M., on May 25th.

Result on Discharge: Condition was good, after 12 days treatment.

CASE 7

Case History No. 1313.

The accident occurred at 9 A.M., June 5, 1928, at Entre Rios.

First Aid: Bite wound was cauterized and then burned with black powder by the patient. A tourniquet was applied loosely above the ankle.

Hospital Admission: June 6, 1928, at 11:30 A.M. No antivenin was used.

Other Treatment Used: Wound was dressed with wet boric dressings.

History of the Accident: The snake bit him on the left foot. It was about one foot in length and was not captured.

Symptoms: Swelling of the foot. About 30 minutes after the accident there was slight bleeding of the gums, but this had ceased on admission to the hospital. There was a small, painful swelling in the popliteal space.

Result on Discharge: Discharged on June 10, 1928 in good condition.

CASE 8

Case History No. 1477.

The accident happened at 6:45 A.M., on June 26, 1928, on Pequot Farm of the Los Andes District.

The patient at once cut the wound open, and cauterized it with a hot iron found in the camp. A tourniquet was applied above and below the elbow. The snake was killed and its intestines applied to the bite. Polyvalent antiophidic serum, from Butantan, was given about 9 hours after the accident.

Hospital Admission: 3:30 P.M., June 26, 1928. Ice cap was applied to the hand and arm. No further treatment.

History of the Accident: He was bitten on the left hand by a "barba amarilla" (*B. atrox*). The snake was of average size, and was empty.

Symptoms: On admission to the hospital the patient was weak and in pain from the swelling of his arm. He was able to walk. Albumin, pus and casts were found in the urine.

Result on Discharge: Discharged, after 8 days, in good condition.

CASE 9

Case History No. 2543.

The accident happened at 11 P.M., Oct. 5, 1928, at the Virginia camps.

First Aid: None.

Hospital Admission: 9:50 A.M., Oct. 6, 1928. He was given 10 cc. of Mulford's antithropic antivenin (about 11 hours after the accident). Ice caps were applied to the hand and arm.

History of the Accident: The patient was going to bed when a snake bit her on the left middle finger. The snake responsible for the accident was a "barba amarilla" (*B. atrox*) that weighed $2\frac{1}{2}$ lbs. and measured, before being fixed in formalin solution, 5 feet 10 inches. Its alimentary tract, near its lower end, contained feathers from the wings and tail of a black bird. This snake no doubt had a full load of venom.

Symptoms: Swelling of the arm and hand, and bleeding from the gums.

Result on Discharge: Discharged on Oct. 15th, in good condition.

OTHER CASES

It is said that five other cases occurred, but these did not enter the hospital and the records are not available.

COSTA RICA DIVISION

CASE 1

Case History No. 491.

The accident occurred Jan. 23, 1928, at Siquirres.

First Aid: None recorded.

Hospital Admission: 6 P.M., Jan. 23, 1928. Antivenin was given on arrival at the hospital, and a second dose on Jan. 25th.

History of the Accident: None recorded; species of snake not known.

Symptoms: No record.

Result on Discharge: Discharged as well after 9 days stay in the hospital.

CASE 2

Case History No. 581.

The accident occurred Feb. 20, 1928, on Blanco Farm of the Zent District.

First Aid: None recorded.

Hospital Admission: 2 P.M., Feb. 20, 1928. One dose of antiophidic serum given on arrival at the hospital.

History of Accident: A boa about 3 meters long bit him on his left thigh. He did not present symptoms.

Result on Discharge: Under observation 2 days. Well.

CASE 3

Case History No. 920.

This accident occurred March 17, 1928, on El Encanto Farm in Monte Verde area, at about mid-day.

First Aid: Antivenin was given shortly after the accident by an employee on a nearby farm.

Hospital Admission: 6:30 P.M., March 17, 1928. The wound was cauterized but no additional serum treatment was given.

History of the Accident: He was bitten on the middle finger of the left hand by a terciopelo (*B. atrox*).

Result on Discharge: Discharged as well, on March 20, 1928.

CASE 4

Case History No. 1387.

This accident occurred April 23, 1928, at Westphalia, Limon.

First Aid: No record.

Hospital Admission: 4:20 P.M., April 25, 1928. The patient was given 2 doses of antithropeic serum on arrival at the hospital.

Other Treatment Used: Ergotin, 1 ampoule, at 9 P.M.; fibrogen, 1 cc., at 9 P.M., and at 10 P.M.; brandy, half ounce, every 4 hours; aspirin 10 grains on admission; calcium chloride, 5 grains, every 2 hours.

History of Accident: He was bitten on the left foot by an unknown species of snake, 24 hours before his admission to the hospital. Bleeding from gums recorded. Delirious.

Result on Discharge: Died at 7:50 A.M., April 26, 1928.

CASE 5

Case History No. 1570.

The accident occurred May 9th, 1928, at Estrada.

First Aid: No record.

Hospital Admission: 4:30 P.M., May 9, 1928. He was given 2 doses of antivenin on arrival at the hospital.

History of Accident: No history of the location of the bite was received, and the species of snake was not known.

Symptoms: No notable symptoms developed.

Result on Discharge: No record of duration of stay in the hospital was reported.

CASE 6

Case History No. 1783.

The accident happened on Pacuare Farm of Zent District, May 23, 1928.

First Aid: A dose of antivenin was given at the farm soon after the accident.

Hospital Admission: 5 P.M., May 23, 1928. A second dose of antivenin was given at 8 P.M., May 24, 1928.

History of Accident: He was bitten on the left forearm by a green snake. The arm showed slight swelling and two fang marks, but he did not feel sick. Albumin was found in the urine.

Result on Discharge: Condition good, after 5 days in the hospital.

CASE 7

Case History No. 2703.

The accident happened on Toro Farm, Zent District, July 25, 1928.

First Aid: One dose of antivenin was given at 9 A.M., July 25, 1928.

Hospital Admission: 4:15 P.M., July 25, 1928. Another dose of antivenin was given.

History of Accident: He was bitten on the second finger of the left hand by a "sleeping goffe" (*B. schlegelii*).

Symptoms: He did not show any symptoms, except for a slight rise in temperature to 99°F.

Result on Discharge: July 28, 1928; well.

CASE 8

Case History No. 2719.

The accident occurred on Celina Farm, of the Zent District, at 2:30 P.M., July 26, 1928.

First Aid: A dose of antivenin was given by a farm employee soon after the accident.

Hospital Admission: 10:30 P.M., July 26, 1928. Another dose of antivenin was given, and calcium chloride was employed.

History of Accident: He was bitten on the little finger of the right hand by an unidentified snake.

Symptoms: Right hand somewhat swollen.

Result on Discharge: July 29, 1928. Well.

CASE 9

Case History No. 2939.

The accident happened on Barmouth East Farm, Zent District, Aug. 8, 1928.

First Aid: None.

Hospital Admission: 6:45 P.M., Aug. 8, 1928. Two doses of antivenin were given after arrival at hospital. Morphine, and calcium chloride, administered.

History of Accident: The snake bit the base of the left index finger. The species of snake was unknown.

Symptoms: Swelling of the hand.

Result on Discharge: Aug. 14, 1928. Well.

CASE 10

Case History No. 3582.

The accident occurred on Celina Farm, Zent District, at 10:30 A.M., Sept. 13, 1928.

First Aid: A dose of antivenin was given an hour after the accident.

Hospital Admission: 4:30 P.M., Sept. 13, 1928. One ampoule of #3 antiophidic serum (Butantan) was given.

History of Accident: Bitten on left index finger by a light-colored, flat-headed snake.

Symptoms: The fang marks were plainly visible. No symptoms developed.

Result on Discharge: Sept. 16, 1928. Well.

CASE 11

Case History No. 4225.

The accident happened at Farm Philadelphia North, at noon, Nov. 14, 1928.

First Aid: One ampoule of antivenin was given 2½ hours after the accident.

Hospital Admission: 7:30 P.M., Nov. 14, 1928. Iodine was painted over the wound. Wet dressings were applied to the foot.

History of the Accident: He was bitten on the right foot by a small snake that was not identified.

Symptoms: Some swelling and tenderness of the foot.

Result on Discharge: Nov. 19, 1928. Well.

CASE 12

Case History No. 4278.

Accident occurred at San Cecilio, Banana River District, at 9 A.M., Nov. 20, 1928.

First Aid: A dose of antivenin was given 15 minutes after the accident.

Hospital Admission: 12:40 P.M., Nov. 20, 1928. Two doses of antivenin were given at the time of admission, and repeated at 6:20 P.M. and at 1 P.M., Nov. 20th.

History of the Accident: He was bitten by a terciopelo snake (*B. atrox*) about 1½ meters long. The bite was on the left forearm.

Symptoms: The arm and shoulder were swollen, painful and discolored. Blisters appeared on the hand. There was bleeding from the gums and the patient expectorated bloody sputum. The urine was dark in color. Coma developed on the 24th of Nov.

Result on Discharge: Died, 9:35 A.M., on Nov. 24, 1928.

CASE 13

Case History No. 4302.

The accident occurred on Buffalo Farm, Zent District, Nov. 22, 1928, at 8 A.M.

First Aid: One dose of antivenin was given at the farm by an employee.

Hospital Admission: 1 P.M., Nov. 22, 1928. Antivenin was repeated at 1:30 P.M. on Nov. 22nd, at 1 A.M. on Nov. 23, and at 7 A.M. on Nov. 24th. Sedatives and calcium chloride were also given.

History of the Accident: She was bitten on the right hand by a terciopelo snake (*B. atrox*). The snake was about 18 inches long.

Symptoms: Hand and arm swollen and painful. No comment in regard to bleeding. Temperature rose to 102°F.

Result on Discharge: Discharged Nov. 28, 1928. Cured.

CASE 14

Case History No. 4606.

The accident occurred on Guacimo Farm, Santa Clara District, Dec. 16, 1928, at 8 P.M.

First Aid: A dose of antivenin was given 5 hours after the accident; and then repeated in two hours and again 4 hours later, and at 11 A.M. the next day. All of these doses were given at the farm or in the Dispensary.

Hospital Admission: 5 P.M., Dec. 17, 1928. Another dose of antivenin was given.

History of Accident: The patient had been bitten on the left foot by a terciopelo snake (*B. atrox*), about 1 foot long.

Symptoms: Began expectorating bloody sputum soon after the accident. The foot was swollen. Bloody expectoration ceased on the 18th, and the swelling in the foot was greatly reduced. The urine contained albumin, in a large amount, throughout his illness.

Result on Discharge: Dec. 27, 1928. Well.

CASE 15

Case History No. 4692.

The accident occurred Dec. 26, 1928, on Monte Verde Farm in the Zent District.

First Aid: None.

Hospital Admission: 5 P.M., Dec. 26, 1928. Two doses of antivenin were given on admission.

History of Accident: He stated that he was bitten on the middle finger of the left hand by a small toboba (*B. schlegelii*).

Symptoms: He did not feel sick, but his temperature rose to 99°F.

Result on Discharge: Dec. 28, 1928. Well.

PANAMA DIVISION

CASE 1

Case History No. 22663.

This accident occurred at 5:30 P.M., June 1, 1928, on Lari Farm.

First Aid: Ligature around finger.

Hospital Admission: 9:05 P.M., June 1, 1928. The first dose of antivenin was given about 4 hours after the accident (Polyvalent antiotheropic serum). The wound was incised, and dressed with 1% potassium permanganate.

History of Accident: Patient was a brakeman on a fruit train and as he placed his hand between the planks of the car where some dry banana leaves were lying he was bitten on the end of his right index finger. There were 2 fang marks present. The snake was not captured.

Symptoms: Pain in finger and arm; later he had a chill, but otherwise there were no subjective symptoms. Slight bleeding of the gums on light pressure. The urine showed some casts.

Result on Discharge: In hospital 1 day and 2 nights. Well.

CASE 2

Case History No. 23671.

The accident occurred at 10:30 A.M., Oct. 15, 1928, on Farm 6.

First Aid: A tourniquet was applied above the knee 2½ hours after the accident; the wound was incised and potassium permanganate applied.

Hospital Admission: 2:30 P.M., Oct. 15, 1928. Antithrotophic serum (10 cc.) was given intravenously $4\frac{1}{4}$ hours after the accident. Polyvalent Butantan product was used.

History of the Accident: The patient was cleaning a cacao farm when he was bitten about the middle of the right leg by a fer-de-lance (*B. atrox*) about 2 feet long. The snake had a lump in its body.

Symptoms: About a half hour after the accident there was pain at the site of the wound. He began to bleed from the mouth about $1\frac{1}{2}$ hours after the accident.

Physical Examination: No local swelling, discoloration, or bleeding.

Result on Discharge: Discharged, after 48 hours, as cured.

CASE 3

Case History No. 23649.

This accident occurred at 8 A.M., Oct. 13, 1928, on Lari Farm.

First Aid: Patient put some garlic on the wound.

Hospital Admission: 1 P.M., Oct. 13, 1928. He was given 10 cc. of polyvalent Butantan antithrotophic serum intravenously 5 hours after the accident. Potassium permanganate was applied to the wound.

History of the Accident: The patient was lifting a log out of the grass when he was bitten on the left big toe. He did not see the snake but fang marks were found on the toe. The species of the snake is, of course, unknown.

Symptoms: There was intense pain immediately in the foot and leg, and bleeding at the site of the fang marks.

Physical Examination: There was some discoloration of the toe, but the leg was not swollen. No general symptoms developed. [Possibly a scorpion sting?] The patient also had syphilis and nephritis, which prolonged his stay in the Hospital.

Result on Discharge: Well, so far as the bite was concerned.

CASE 4

Case History No. 23666.

This accident occurred at 7 A.M., on Oct. 15, 1928, at Almirante.

First Aid: None.

Hospital Admission: 12:30 P.M., Oct. 15, 1928. No antivenin was used.

History of Accident: He was standing under a banana tree when he was bitten on the left wrist by a green and white snake about 1 foot long. The snake was not captured.

Symptoms: There was a little pain at the site of the bite, but no further symptoms developed.

Result on Discharge: Discharged after 24 hours. Well.

CASE 5

Case History No. 23451.

Date, Place and History of Accident.—The accident occurred at 10:00 A.M., September 18, 1928, on Senosri Farm. The victim was seated on the trunk of a dead tree when the snake struck him on the posterior side, lower third, of the right foreleg. The snake was killed one hour later, and sent to the Hospital, where it was identified as a "bushmaster" or *Lachesis mutus*. It was approximately 5 feet long. There was no lump of food in its body.

First Aid Treatment.—The patient tied a string around his leg above the knee, immediately after the accident.

Hospital Admission.—2:00 P.M., September 18, 1928.

Symptoms.—The patient stated that immediately after he was bitten he felt an intense pain in his entire leg, which was followed quickly by swelling and

discoloration of the limb. One hour after the accident he started to vomit blood and to bleed from the nose. At the time of admission the patient was nearly pulseless, and frequently vomited bloody, foamy masses.

Treatment Given.—2:15 P.M., September 18, he was given 10 cc., of polyvalent Butantan anti-bothropic serum intravenously; and this dosage was repeated at 7:00 P.M., September 18, and again at 10:00 A.M., September 19. He received 1000 cc. of normal saline, administered hypodermically. During the first few hours subsequent to his admission his pulse improved slightly; but he complained of an insatiable thirst, and had intense pains in the right leg and in the right lower quadrant of the abdomen. The discoloration of the skin increased, and on the morning of September 19 it was a dark purplish color with the epidermis detached from the subcutis by large blisters which were filled with a bluish haemorrhagic fluid. The patient's pulse became progressively weaker, until his death. There was no haemorrhage during his last hours.

Duration of Stay in Hospital.—The patient died 20 hours after he was admitted to the Hospital; or 24 hours after the accident occurred.

CHIRIQUI LAND COMPANY

CASE 1

Date, Place and History of Accident.—C. F., Panamanian, male, aged 20 years, residing in the Blanco District, was bitten on the dorsal surface of the left foot while in his manacca shack, at 6:30 A.M., June 7, 1928. The snake escaped, but judging by the description given by the patient it may have been a *Bothrops atrox*.

First Aid Treatment.—The leg was ligated by a handkerchief tied tightly just above the ankle.

Hospital Admission.—9:30 A.M., June 8, 1928.

Symptoms.—Shortly after the accident the victim developed pain and swelling in the foot and ankle, and bled from the mouth and nose.

Physical Examination.—The patient was a well developed and nourished native, whose general physical condition was good although he had an enlarged spleen. When he was admitted to the Hospital, there was some bleeding at the gums of his teeth. The examination revealed two minute puncture wounds on the instep of the left foot, about $\frac{1}{2}$ inch apart. Blood was oozing from these wounds, and the foot was cyanosed and very much swollen. The patient was apparently suffering considerable pain.

Treatment Given.—Immediately after the patient was admitted, he was given 10 cc. of Mulford's antiothropic serum, intramuscularly. Saturated solutions of permanganate were applied to the site of the bite.

Duration of Stay in Hospital.—The patient improved gradually and was discharged on June 11, 1928, as he was physically capable of resuming work.

CASE 2

Date, Place, and History of Accident.—J. A., Nicaraguan, male, aged 26 years, residing in the Esperanza District, was bitten just above the ankle, at about 5:00 P.M., August 23, 1928. The man killed the snake, and stated that it was a "terciopelo" (*Bothrops atrox*).

First Aid Treatment.—The Company's Dispenser desired to give an injection of antivenin serum, but the patient refused treatment and consulted a native "Snake Doctor." There was some bleeding at the site of the injury on August 24. On August 26 the patient expectorated blood, and developed haematuria that night. During the period mentioned (August 23 to August 26) he declined to accept attention from our medical staff and continued under the care of the "Snake Doctor." On August 26, the latter informed the patient that he was

unable to cure him as he had had gonorrhoea in the past. On August 27, the Company's Dispenser administered 10 cc. of Mulford's antiothropic serum, and sent the patient to the hospital.

Hospital Admission.—August 27, 1928.

Symptoms.—On admission the patient was in a very weakened condition, with increased respirations and a rapid pulse. The gums and the wounds at the site of the injury were bleeding, and the urine was very bloody.

Treatment Given.—He was given immediately 10 cc. of Mulford's antiothropic serum, intravenously. He passed a very restless night, but was slightly improved in the morning of August 28; the urine was clearing, and there was very little haemorrhage from the gums. On August 29, the bleeding had ceased, and the patient's condition was very much improved. Saturated solutions of permanganate were applied to the site of the bite, during the course of treatment in the Hospital.

Duration of Stay in Hospital.—The patient was discharged on September 6, 1928, in good condition.

CASE 3

Date, Place, and History of Accident.—J. D., Panamanian, male, aged 20 years, residing in Puerto Armuelles, while working near the Guanabano River, suddenly felt a sting in the 3rd toe of the right foot, at about 10:00 A.M., on October 10, 1928. The snake was not captured, and the patient could not describe it accurately.

First Aid Treatment.—A ligature was applied above the right knee.

Hospital Admission.—4:00 P.M., October 10, 1928.

Symptoms.—At the time of admission, the entire leg was painful and cyanosed, and very much swollen. Only one wound was found on the injured toe; but it was bleeding rather profusely, and the gums were bleeding slightly.

Treatment Given.—The patient was given 10 cc. of Mulford's antiothropic serum, intramuscularly; and saturated solutions of permanganate were applied to the wound.

Duration of Stay in Hospital.—The patient improved rapidly, and was discharged on October 13, 1928, as he was capable of resuming work.

CASE 4

Date, Place, and History of Accident.—J. E., Jamaican, aged 34 years, residing in the Blanco District, was bitten in the palm of the left hand while planting banana "suckers," November 3, 1928. The snake was not seen.

First Aid Treatment.—None recorded.

Hospital Admission.—November 3, 1928, two hours after the accident occurred.

Symptoms.—A piece of bejuco had been tied around the forearm, which was swollen as the result of venous stasis. There was slight bleeding at the site of the bite.

Treatment Given.—The patient was given 10 cc. of Mulford's antiothropic serum immediately after admission, and saturated solutions of permanganate were applied to the site of the bite.

Duration of Stay in Hospital.—The period is not stated in the case report rendered; but it is asserted that "the patient made a rapid recovery."

CASE 5

A man was bitten by a snake at Berba Farm, in the Esperanza District, on October 16th, and died on October 18, 1928. He did not apply to the Medical Department for treatment, but enlisted the services of a native "Snake Doctor."

CASES 6 AND 7

Two other snake-bite cases were reported by the Medical Department of the Chiriqui Land Company, but they recovered promptly and did not require injections of antivenin serum.

SUMMARY

1. The 46 cases reported show the following incidence by countries:

Colombia	0
Costa Rica	15
Guatemala	9
Honduras	10
Panama	12
Total	46

The high incidence of *B. schlegelii* in Costa Rica probably explains the relatively large number of snake-bite accidents there and also the minor character of some of the injuries.

The Colombia Division has its quota of snakes and its share of the poisonous species; yet snake-bite cases are rarely heard of in this Division. I believe this is explained by the fact that it is an irrigation project and the farms are shovel-cleaned or skinned almost as bare as a baseball diamond.

This affords little shelter and the snakes seek the fence rows, pastures and woodland. The laborers are therefore not exposed to the same degree of risk as they are in the other mainland Divisions.

2. The anatomical distribution of the bites were as follows:

Right hand	2	Left hand	2
Right little finger	1	Left little finger	1
Right index finger	1	Left index finger	5
Right thumb	1	Left middle finger	5
Right wrist	1	Left ring finger	2
Right forearm	1	Left wrist	2
Right shoulder	1	Left forearm	2
Right third toe	1	Left foot	5
Right foot	1	Left big toe	1
Right leg	2	Left third toe	1
Total	12	Left little toe	1
		Left thigh	1
		Total	28
Left Extremities	28		
Right "	12		
Unrecorded sites	6		

The predilection for the left side is probably due to the fact that most people are right handed and hold some implement in the right hand while the left hand is used to grasp things and the left foot is braced in a forward position to preserve balance while the right arm swings the implement. The ratio of the left

and right side bite locations is more than 2 to 1 in favor of the left side, and most of the accidents are limited to the hands and feet.

3. The well established cases of *B. atrox* accidents during the past few years indicate that about 80% of them occur in the early morning hours while most of the remainder occur in the late evening hours. This of course relates to a day-time labor force. The snake is nocturnal in its habits.

4. The records of the past few years would appear to indicate that the greatest *B. atrox* hazard in these fruit divisions is in June, July and August. This may be due to business reasons, such as the apex of the fruit season with its large labor force—yet my personal experience in Panama and Honduras reveals the fact that gravid females are more frequently encountered at this period of time. These females cannot run well in this condition, and are usually in a more or less starved, ill-tempered condition. They take the defensive, and are apt to be aggressive.

5. Many of the cases in this series show too great a delay in the administration of antivenin. They should be given the initial dose of antivenin by the farm staff where the accidents occur, before sending them to the hospital for the follow-up treatment. This is possible, now that the antivenin is a product that can be stored with safety with the rural units.

6. It is necessary to again express the hope that the medical staff in each Division will endeavor to educate the rural inhabitants in the subject of snake-bite. Their help is needed to secure an accurate knowledge of the species of snake responsible for such accidents. Capture the snakes and have them identified. The Museum of Comparative Zoology at Harvard University is anxious to secure scientific records concerning these snakes, and particularly regarding the food articles that are to be found in them. Our records are still too fragmentary to have full value.

7. The prognosis in a case depends on a knowledge of what snake caused the accident; and the dosage of antivenin required by a patient bitten by a poisonous species of snake depends on how much venom was injected into the patient, which can be roughly estimated if the snake is examined for food contents and the degree of digestion determined. A recently ingested meal indicates that there was only a small quantity of venom in the glands when the bite was inflicted; while an empty alimentary tract indicates that a large amount of venom was probably injected into the victim, and the prognosis is serious.

A gravid female near full term is also a serious risk, and treatment should be given accordingly.

8. Five (10.9%) of the 46 cases recorded in this series died.

SNAKES FROM THE CHIRIQUI LAND COMPANY

H. C. CLARK, M.D.

Medical Department, United Fruit Company

The Chiriqui Land Company is a new banana Division that has been in the process of clearing and fruit planting during the latter half of the year 1927 and all of the year 1928. This character of development is still in progress, although some areas are now producing bananas. The land lies on the Pacific coast very near the border of Costa Rica. Its center is approximately 8°29' N. latitude and 82°50' W. longitude. I spent several weeks in this Division during the months of May and June, 1928, and during that time there were two snake-bite accidents among the laborers and one alleged fatal snake-bite accident to a saddle horse. We were not able to secure the snakes causing the accidents but from the description given by the laborers it would appear reasonably certain that they were due to the *fer-de-lance*.

There was no hospital organization in this Division at that time, as there were only a small number of men in the administration offices and the usual labor camps scattered throughout areas that were being cleared and planted. This made it difficult to undertake a snake census, since there were no facilities for assembling and storing a collection of snake specimens. It seemed advisable, however, to learn the relative incidence of the poisonous species present in the primitive jungle prior to the establishment of the large banana farms in order to compare the rates with a larger census that we hope to make after the banana cultivation has been established a few years.

To conduct a thorough census requires a large labor force daily employed and evenly scattered over the entire Division. These conditions did not prevail in the Chiriqui Land Company Division at the time of my visit. There were about four areas, excluding the port, where small labor forces were at work. I supplied these areas with cans of formalin solution in which to keep the specimens, and then arranged a bounty of 25 cents a head for snakes that were believed to be poisonous species. It was, of course, too much to expect that a labor force of this character would be able in every instance to know whether a snake captured was venomous, but the general result was more or less satisfactory. Within the next six months I received a shipment of 78 embalmed snake heads, of which 61 (78.2%) represented venomous species. The entire shipment was forwarded to Dr. Thomas Barbour, Museum of Comparative Zoology, Harvard University, Cambridge, Mass. for identification. I shall only record that part of his report which relates to the poisonous species, as follows:

- 52 *Bothrops atrox* (fer-de-lance)
- 7 *Bothrops schlegelii* (horned palm viper)
- 1 *Lachesis mutus* (bushmaster)
- 1 *Micrurus nigrocinctus* (coral snake)

This little census confirms the fact, disclosed previously by the Honduras census conducted in the Division of the Tela Railroad Company, that the *fer-de-lance* is the most common poisonous snake in the fruit zones of the coastal plains of Central America.

It is worthy of comment that one *bushmaster* was found in this small census, as we have not yet found this species in the lowlands of Honduras even though several thousands of snake specimens from that region have now been examined. I have seen one fine specimen of this species captured recently in the middle of the Canal Zone. The species is not infrequently encountered in Panama but, apparently, its incidence is exceedingly small as compared to that of the *fer-de-lance*. Anyone who has occasion to pass through the Canal Zone and wishes to see a fine specimen of the *bushmaster* can have that opportunity by calling at the Board of Health Laboratory, Ancon, C. Z.

The Chiriqui Land Company will soon cover a large area of coastal plain and, after a few years pass, the rodent life will become abundant on its farms. The labor force will be numerous enough to supply large cleaning gangs, that will periodically cover the entire Division. It is suggested that a more extensive snake census be conducted when that period of development has been reached.

BOTHRUPS NUMMIFIERA IN HONDURAS

H. C. CLARK, M.D.

Medical Department, United Fruit Company

The serpentarium at Tela (Lancetilla), Honduras, has been successful in adding to our information on the poisonous species common to that region.

Bothrops nummifera known locally as "*Mano de Piedra*" and "*Timbo*" has been added to the list of known snake hazards. This species was not found in the general census completed in 1925.

A detailed account of it by D. D. H. March appears in Unifruitco, of February, 1929. A short summary of his report follows:

It is a short snake two to three feet in length, but has a head and girth equal to that of a large rattler. It is strong enough to throw itself clear of the ground when in a striking mood.

B. nummifera is subject to great variation in color although the pattern is constant, except in the case of the black phase where the pattern is entirely wanting. The color ranges from yellowish grey with brown saddles, and bright orange with fawn saddles, all through the reds and browns with beautifully contrasting markings, to the melanistic specimens entirely devoid of pattern. [This color variation is also a characteristic of *B. schlegelii*, the "horned palm viper".]

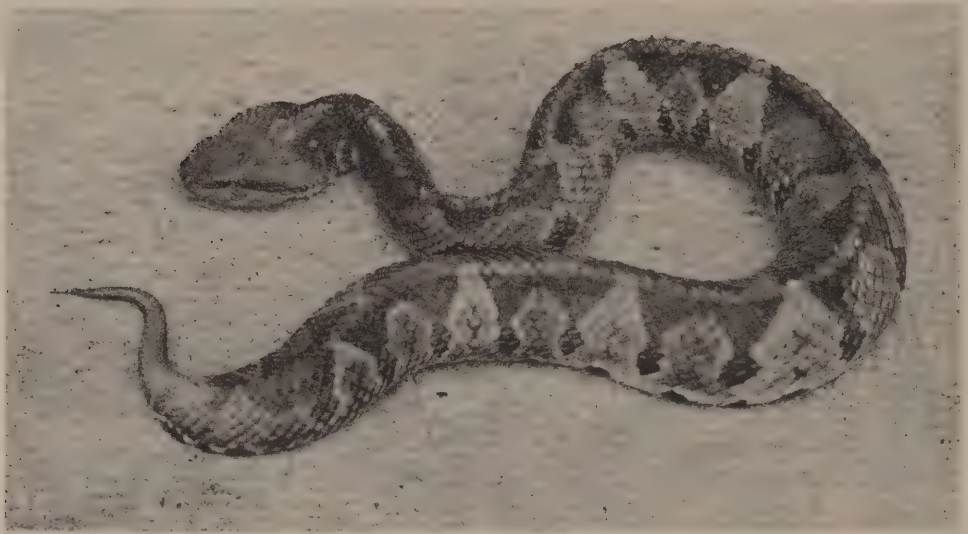


FIG. 1. *BOTHROPS NUMMIFERA*, KNOWN AS THE "MANO DE PIEDRA," OR "TIMBO"
(Photo by Coville, Tela, Honduras)

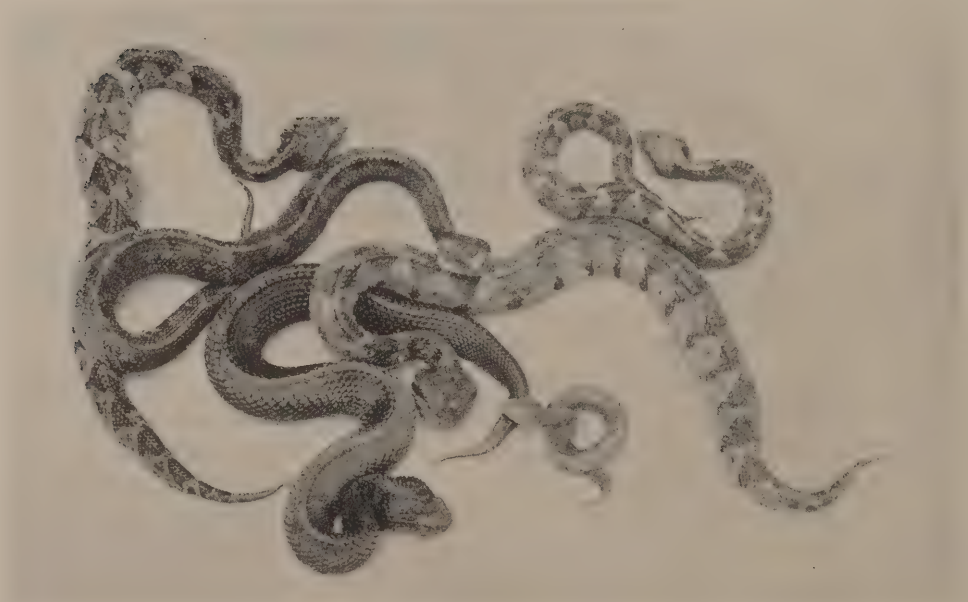


FIG. 2. SEVERAL SPECIMENS OF *BOTHROPS NUMMIFERA*, SHOWING A WIDE VARIATION IN COLOR
(Photo by Coville, Tela, Honduras)

The species is ovoviviparous and its young number from 12 to 20. The adults feed on small mammals and birds and, sometimes, on lizards and toads.

It is believed (from its habits in the serpentarium at Tela) to be nocturnal in its habits.

Its range is restricted, in a spotty manner, to the forested hill regions. The same species is said to be present in Mexico. [I doubt if the species will ever become a serious risk to the labor forces in the banana zones or lowlands, but it may require attention where large labor forces are engaged in field work on the coffee plantations and cattle-grazing areas which are at a higher elevation. It is probable that our present antiothropic serum will care for bites inflicted by this species.]

BRIEF REVIEW OF "THE DIAGNOSTICS AND TREATMENT OF TROPICAL DISEASES,"* BY E. R. STITT, A.B., PH.G., M.D.

This exhaustive treatise can not be classed as a compendium of tropical medicine since it comprises 918 pages. Yet within this limit is abstracted, concisely but accurately, most of the sum of our present knowledge with respect to diseases of the torrid zone. The author has been ably assisted by well-known specialists of the Medical Corps of the United States Navy, and the result may be said to represent the views of himself and his associates on the known facts as well as on problems yet unsolved in this particular field. Not all workers in the Tropics will be in accord with these views, but their inclusion in this volume is a valuable contribution to the literature. It is interesting indeed to note that one of such wide experience and such sound judgment as Admiral Stitt, finds himself practically convinced of the identity of syphilis and yaws. If this be true, then it is the first proved example of a disease which has a symptomatology in tropical regions not found elsewhere.

The chapters on diseases due to Protozoa, Bacteria, and the Filterable Viruses are comprehensive, and easily readable. Tularemia is included, since "The rapidly increasing frequency of reported cases suggests a prevalence far in excess of the figures." Rabbits and squirrels are common enough in Central and Northern South America, and perhaps tularemia may make its way southward.

Yellow fever has been restored to the section on filterable virus diseases. In the preface the author states "It must impress every one as remarkable that . . . the researches of Reed, Carrol, Lazaer and Agramonte should have been found complete epidemiological presentations." Here, perhaps, it might be noted that more than one worker in the vineyard of tropical medicine has never been otherwise impressed. The confirmation of the labors of Reed and his colleagues is attributed to the work of the West African Yellow Fever Com-

* Fifth Edition, Revised. Published by P. Blakiston's Son & Co., Philadelphia, Pa.

mission of the Rockefeller Foundation, during which the lamentable death of Noguchi occurred. The reviewer would take the liberty here to recall the equally important work in Brazil of Sellards, of the Harvard School of Tropical Medicine.

The chapters on Malaria and Blackwater Fever are of particular interest, representing as they do the wide experience and considered opinions of the author and his colleagues. The pathology of malignant tertian is largely based on Choisser's findings in Haiti. The younger sexual forms of the parasite are termed "sexualovoids." Here, as in other works on this subject, the very accurate and complete account of the development of the sexual cycle of *P. falciparum*, beautifully illustrated, given years ago by David Thompson, is overlooked.

Under treatment, the author rightly condemns the intravenous injection of quinine in low dilutions. Apparently he is of the opinion that the chief value of plasmochin is in destroying the gametes of *P. falciparum*, and regards this drug as an invaluable method of prophylaxis against crescent-carriers.

In the chapter on Blackwater Fever, the pioneer contributions of the American workers in the Canal Zone are not mentioned. Yet it was this work that first placed the relationship between aestivo-autumnal malaria and blackwater fever on a definite basis.

The chapter on Amoebic Dysentery deals mostly with the dysenteric aspect of the disease, and little or no attention is paid to the far more frequently found cases of amoebiasis without dysentery. The proper diagnosis of the latter is one of the most difficult tasks in tropical medicine, and elsewhere also, and indeed should be more fully treated in text books.

The reviewer has read nowhere in recent years a more succinct and valuable contribution than the chapters on Nutritional Disorders. Lack of a balanced diet is responsible, in the Tropics particularly, for an immense amount of gastrointestinal distress, with many and varied complications, which often so mask and disguise underlying associated diseases and infections as to render correct diagnosis and treatment matters of most careful study and untiring patience. The vitamins are discussed in detail, and the present knowledge of them and their actions is clearly set forth. When the general practitioner in the Tropics, and most of us in the last analysis are of necessity classed as such, will have come to a better realization of the relationship between diet and disease, we shall have made an advance almost comparable to that obtained by our knowledge of the infectious diseases and control of them, with a corresponding advance in the public health. We are indeed indebted to Admiral Stitt and his colleagues for so admirable a presentation. It is refreshing and grateful to turn for a while from the vast literature devoted to the cause of purely scientific research, and to read a little common sense.

Equally of practical and scientific value are the contributions of Commander Stuart on the problems of medical and surgical practice in the Tropics, and Lt. Commander Harper's clear and concise exposition of laboratory procedures. A meticulous critic might regard the section devoted to the "Index on Clinical

Diagnosis" as savoring of a cut-and-dried system, but the general practitioner will more than once refer to it with gratitude.

The concluding article on Tropical Hygiene is the most complete summary of this subject known to the reviewer. The opinion that sea-level tropical climates can be made into veritable paradises for colonization and subsequent propagation of the Anglo-Saxon race, rests on the great authority of Gorgas, based on his experience with North American workers and their families in the Canal Zone during the construction days of the Panama Canal.

A very different story is found in the quotation from Balfour, on page 857. The solution of this problem lies in the future. What the Anglo-Saxon race will do in such climates, under very favorable conditions of living and sanitation, can not be predicted from the life of one generation in the Canal Zone or elsewhere, even under the present favorable circumstances. The reviewer, however, humbly offers as his opinion that the trend will be downward, in which he differs with the author, who is of the opinion that the evidence favors the views of Gorgas and of those who agree with him. Twenty-three years of continuous general practice in the Canal Zone and Panama have left a very strong impression that North American children, and not only these, but Panaman children as well, do markedly better, mentally and physically, in temperate climates, and a frequent change is highly beneficial as well to adults, and especially women, of both races.

It is gratifying to note that the Annual Report of the Medical Department of the United Fruit Company has been chosen by the author as a basis upon which to formulate comparative statistics of health and disease in the Tropics.

In the reviewer's opinion, this is one of the most valuable treatises on the subject at our command, and in general it is equalled by few, and surpassed by none in the presentation of the subject. In the matter included in the appendices, it is especially of worth to the general practitioner in the Tropics, who must rely far more than his brother in temperate climates on the microscope and the laboratory. Perhaps a future edition will contain a section on microscopy. A consideration of the proper handling of the microscope and its accessories is nowhere to be found in similar treatises, and such an inclusion would be of practical service.

Not the least value in Admiral Stitt's latest revision of his book is that it largely represents the views of the workers in the Medical Corps of the United States Navy on the included subjects, and as such is of particular interest.

W. M. JAMES, M. D.

Panama City, R. P.

ABSTRACTS FROM RECENT PUBLICATIONS ON ENTAMOEBA HISTOLYTICA BY CLIFFORD DOBELL AND HIS ASSOCIATES

1. *The Action of Ipecacuanha Alkaloids on Entamoeba histolytica and Some Other Entozoic Amoebae in Culture*: Clifford Dobell and P. P. Laidlaw. Parasitology: Vol. XVIII, No. 2, 16 July, 1926.

2. *On the Cultivation of Entamoeba histolytica and Some Other Entozoic Amoebae*: Clifford Dobell and P. P. Laidlaw. Parasitology: Vol. XVIII, No. 3, 14 September, 1926.

3. *Further Experiments on the Action of Emetin in Cultures of Entamoeba histolytica*: P. P. Laidlaw, Clifford Dobell, and Ann Bishop. Parasitology: Vol. XX, No. 2, 13 July, 1928.

4. *Researches on the Intestinal Protozoa of Monkeys and Man—I. General Introduction, and II. Description of the Whole Life History of Entamoeba histolytica in Cultures*: Clifford Dobell, F.R.S. Parasitology: Vol. XX, No. 4, 12 December, 1928.

The discovery by Boeck and Drbohlav, in 1924, of a medium in which *E. histolytica* could be grown successfully, opened fields of research in the life history of this parasite of man which prior to that date had been closed. It also offered opportunity to study with comparative accuracy the effects of drugs against the organism, within reasonable limits. Studies along these lines have been, and are being, constantly reported from many sources. At the request of Dr. W. E. Deeks, these four papers have been abstracted, since they are the results of three years close application to these problems by workers of highest repute. It is not intended to overlook the very valuable work done elsewhere and by others. It is because of the wide field covered by Professor Dobell and his associates, Dr. Laidlaw and Miss Bishop; and the impossibility at this time of presenting a review of the great amount of research that has been done, and still is in progress; that this selection has been made, as being within its compass the most comprehensive at this date. In the next Annual Report of the Medical Department of the United Fruit Company it is hoped to present a full summary of the remarkable advances since the Amoebae of Man, and other entozoic amoebae as well, have been successfully cultivated.

It was early noted that the original media of Boeck and Drbohlav gave uncertain results. Overgrowths of bacteria and blastocytes frequently killed the amoebae, and encystation and excystation could not be produced with regularity sufficient to study the life cycle. The methods by which these difficulties were finally overcome not only reflect great credit on the ingenuity and perseverance of the authors, but form a fascinating chapter in the annals of purely scientific research. In the fourth paper Professor Dobell describes in detail his remarkable findings in the life cycle of *histolytica*. Encystation *in vitro* is identical with that

previously observed in the human large intestine, and can be produced at will, by transplanting the trophozoites, or free forms, designated by Dobell as *trophic* amoeba, from cultures in a medium which is free of starch, to a similar medium containing starch. The precystic stages pass to complete quadrinucleate cysts in about six hours.

Excystation, however, is a vastly complicated process. The quadrinucleate amoeba in the cyst escapes, not without much labor, through a small pore in the cyst wall. The original four nuclei are termed cystic nuclei. The amoeba does not divide into four daughter amoebae, or amoebulae, but each of the original, or cystic nuclei, divides, so that the end product is eight amoebulae. This division does not take place simultaneously, but by successive stages; and every division of the cytoplasm is preceded by a nuclear division. Every possible permutation and combination is thus produced. The metacystic amoebae, as those resulting from excystment are called, show every variety of division in the cystic nuclei associated with the formation of daughter nuclei. A metacystic amoeba may show three cystic nuclei, with two daughter nuclei resulting from the division of the fourth nucleus, or it may show six daughter nuclei, and one cystic nucleus. The whole of this remarkable process is illustrated in detail with the author's accustomed skill and fidelity. A further brief abstract of this (the fourth) paper, would be an injustice to the author. It must be read; and not read only, but studied as well; to realize its full value. It is a landmark in Protozoology; and a completion of our knowledge of the life cycle of this parasite, hitherto sadly lacking; worthy of the distinguished scientist whose contribution it is. It is interesting to note that the author has found no evidence of conjugation or gamete formation, and no fusion of individuals or nuclei. The process is reported in detail only for *histolytica*; but parallel studies on the other amoebae of man are in progress, and the author mentions he has made sufficient observations to warrant the statement that excystation by this method occurs also in other entozoic amoebae, and in some free living forms.

The fourth paper is an extension of the second, and includes the researches begun in the latter, for which reason the second is not abstracted.

But, however valuable the study of the life cycle of a parasite pathogenic to man may be, the clinician turns equally to the study of methods whereby the enemy may be attacked. In the first and third papers experiments with various drugs are recounted in detail. The discrepancies in similar studies among various workers are noted. It is pointed out that a constant in media, temperature, and other essentials to culture must be determined, if results are to be compared accurately; otherwise comparisons are valueless. The usual combination of a fluid and solid medium for this purpose is shown to be inadequate, since the solid part of the medium adsorbs the diluted drug in greater or lesser proportion, leaving an indeterminate active quantity in solution. To surmount this difficulty a purely liquid medium was devised, in which it was found, when working with emetine, that there was but little loss of alkaloid after incubation of the

culture, and the apparent loss lay within the expected error of the method of estimation.

The results of the experiments showed that *in vitro* emetine acts directly; and is far more efficacious than any of its compounds except cephaeline (which is more toxic for man; but the authors believe it should be tried further) stovarsol, and quinine.

"*E. coli*, *E. gingivalis*, and *Endolimax nana* have been found comparatively insensitive to the presence of emetine in cultures, *E. coli* being able to withstand a concentration of the alkaloid at least 100 times that which is lethal to *E. histolytica*."

To kill *E. histolytica* instantaneously, a solution of 1 per cent is necessary; but, if allowed to act over a sufficient time, 1 in 5,000,000 is lethal within 4 days, *in vitro*, provided that the medium does not become too acid. Here, also, it is noted that the reaction of the medium plays a very important part. In an acid environment the emetine appears to be less efficacious, although acid media themselves are very harmful to cultural growth.

"In culture emetine has been found 10 times as poisonous as stovarsol, and about 50 times as poisonous as quinine, under identical conditions."

The abstract as above given, is far from complete, and in reality does but little justice to the very great amount of labor involved in the work. Still less does it indicate the careful experimentation and the control conditions. But one has only to compare this work with much of the contemporaneous literature, to be convinced that here one finds the letter and the spirit of genuine scientific inquiry after Truth.

The authors have nowhere sought to reason from *in vitro* to *in vivo*. Those who believe that any one drug is an infallible specific against *histolytica* infection in man will here, perhaps, find reason for revision of their former estimates. Particularly is this true with respect to emetine itself. Theoretically, a maintenance of a 1 to 5,000,000 concentration of the drug within the human body is well within the limits of possibility; but that this will be a constant and active solution reaching the amoebae in tissue, is entirely another matter. Nor does such a supposition take into account the concentration in the lumen of the large bowel, and its effect on the amoebae there present. Perhaps later the effects of other drugs, particularly yatren, may be studied. There is much more to the treatment of human intestinal amoebiasis than the direct action of a drug *in vitro* on *histolytica*; but until more is known of what happens in that most mysterious laboratory of all—the human body itself—we should be grateful indeed for such clear scientific exposition as is set forth in this work. In the meantime, the clinician should not lose sight of the fact that permanent cures of *histolytica* infection have followed many systems of treatment; and, as has been suggested elsewhere, if the colitis is made to heal and the amoebae in the lumen of the bowel are eliminated, the tissues will take care of their own amoebae.

WM. M. JAMES, M.D.

Panama City, R. P.

SECTION VI

ORGANIZATION AND VITAL STATISTICS

SCOPE OF MEDICAL DEPARTMENT

Phases of the Work.—The Medical Department functions with respect to all conditions pertaining to the prevention of disease and the care of the sick and injured. This work embraces the following phases:

- (a) In the Tropics, care of employees and their dependents; and of the inhabitants of communities within the limits of, or contiguous to, the plantations when no other medical service is available.
- (b) On all the Company's steamships, care of passengers and members of the crews.
- (c) In the Domestic Divisions where the Company maintains medical staffs, dispensary service to employees.
- (d) Physical examination of prospective salaried employees, and of all steamship crews before they leave the home port, each voyage.
- (e) Supervision of all matters concerning quarantine and immigration affecting the Company's interests.
- (f) In the Tropical Divisions, supervision and recommendation in all matters pertaining to sanitation.
- (g) Sanitation of the Company's steamships.

For the effective performance of these many and varied duties, the Company maintains fully equipped hospitals and dispensaries in the Tropical Divisions, and dispensary service with sanitary staffs in the ports of New York, Boston, and New Orleans.

PERSONNEL OF THE MEDICAL DEPARTMENT

Name	Title	Graduate of
W. E. Deeks, M.D., A.M.	General Manager, New York, N. Y.	McGill University, Montreal, Quebec, Canada
R. C. Connor, M.D.	Assistant General Manager, New York, N. Y.	University of Texas, Galveston, Texas
H. C. Clark, M.D.	Director of Laboratories and Preventive Medicine, New York, N. Y.	University of Pennsylvania, Philadelphia, Pa.
A. Castellani, M.D., C.M.G., F.R.C.P.	Consultant in Tropical Dermatology, London	University of Florence, Italy
W. M. James, M.D.	Consultant in Tropical Medicine, Panama, R. P.	University of Bonn, Germany
F. B. Mallory, M.D., A.B., A.M.	Consulting Pathologist, Boston, Mass.	University of Virginia, Charlottesville, Va.
R. P. Strong, M.D.	Consultant in Laboratory and Medical Research Work, Boston, Mass.	Harvard University, Boston, Mass.
P. F. Murphy, M.D.	Port Medical Officer, New Orleans, La.	Harvard University, Boston, Mass.
		Tulane University, New Orleans, La.

Name	Title	Graduate of
J. M. Lawler, M.D.	Port Medical Officer, New York, N. Y.	Vanderbilt University, Nashville, Tenn.
J. A. Gatlin, M.D.	Sanitary Inspector, New York, N. Y.	Memphis Hospital Medical College, Memphis, Tenn.
F. X. Crawford, M.D.	Port Medical Officer, Boston, Mass.	Harvard University, Boston, Mass.
Harry Eno, M.D.	District Medical Officer, Cristobal, C. Z. (Samaritan Hospital)	Cornell University (Med. Col.) New York, N. Y.

BANES DIVISION

Name	Title	Graduate of
J. R. Ariza, M.D.	Superintendent	Havana University, Havana, Cuba
A. F. Ruiz, M.D.	Assistant Superintendent	Havana University, Havana, Cuba
R. A. Hernandez, M.D.	Physician	Indiana University, Indianapolis, Ind.
V. Bustillo, M.D.	Physician	Loyola University, Chicago, Ill.
J. Medrano, M.D.	District Medical Officer	Havana University, Havana, Cuba
T. de la Torre, M.D.	District Medical Officer	University of Maryland, Baltimore, Md.
Catharin Cotter, R.N.	Matron	Kings County Hospital, Brooklyn, N. Y.
Lilian Dixon, R.N.	Nurse	Hamilton General Hospital, Hamilton, Ontario, Canada
Francisca Archer, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Violet E. Perkins, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Viola I. Clarke, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Mabel L. Heron, R.N.	Nurse	Public General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—50

CHIRIQUE LAND COMPANY

Name	Title	Graduate of
I. E. Peon, M.D.	Acting Superintendent	Tulane University, New Orleans, La.
Helen Flannagan, R.N.	Matron	Massachusetts General Hospital, Boston, Mass.
J. R. Maltsberger	Laboratory Technician	

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—15

COLOMBIA DIVISION

Name	Title	Graduate of
L. M. Drennan, M.D.	Superintendent	Georgetown University, Washington, D. C.
H. M. Walker, M.D., A.B.	Assistant Superintendent	University of Texas, Galveston, Texas
J. A. Fontalvo, M.D.	District Medical Officer	Universidad de Bolivar, Cartagena, Col.
R. Saenz, M.D.	Physician	Jefferson Medical College, Philadelphia, Pa.
J. E. Llinas, M.D.	Physician	Universidad Nacional de Bogota, Col.
K. C. Brewster, B.S.	Laboratory Technician	New Mexico College of Agric. & Mech., N. M.
Martha W. Vessels, R.N.	Matron	Capital City School of Nursing, Washington, D. C.
Julia M. Daley, R.N.	Nurse	Boston City Hospital, Boston, Mass.
Nona A. Corbett, R.N.	Nurse	St. Mary's Hospital, Brooklyn, N. Y.
Doris Melville, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Mabel M. Willis, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Ruby A. Fray, R.N.	Nurse	Nuttall's Nursing Home, Crossroads, Jamaica

Name	Title	Graduate of
Lee Cahusac, R.N.	Nurse	Nuttall's Nursing Home, Crossroads, Jamaica
Gertrude E. Dunning, R.N.	Nurse	Bristol Royal Infirmary, Bristol, England
Lilian H. Marshall, R.N.	Nurse	Nuttall's Nursing Home, Crossroads, and Public General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—94

COSTA RICA DIVISION

Name	Title	Graduate of
E. I. Salisbury, M.D., F.A.C.S.	Superintendent	Jefferson Medical College, Philadelphia, Pa.
A. A. Facio, M.D., F.A.C.S.		University of Pennsylvania, Philadelphia, Pa. (Medico-Chirurgical College)
M. D. Rojas, M.D., Ph.C.	Assistant Surgeon	Tulane University, New Orleans, La.
C. M. Jimenez, M.D.	Physician	University of Brussels, Belgium
A. Castro, M.D.	Physician	University of Maryland, Baltimore, Md.
F. Zumbado, M.D., B.S.C., M.R.C.S., L.R.C.P.	District Medical Officer	Durham University, Durham, England
A. Lachner Chacon, M.D.	Physician	University of Munich, Munich, Germany
J. C. Register	Laboratory Technician	Army Medical Laboratory, Washington, D. C.
Mary C. Walsh, R.N.	Matron	St. Joseph's Hospital, St. Paul, Minn.
Agnes K. Donegan, R.N.	Nurse	Victoria Hospital, Yorkshire, England
Melva John, A.B., R.N.	Operating Nurse	Denver University, Denver, Colorado (St. Mary's Hospital, Rochester, Minn.)
Thea Hoffmann, R.N.	Nurse	Koblenberg Stift Maydeburg, Germany
Sibyl E. Chaplin, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Josephine W. Shrine, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Melita Rodriguez, R.N.	Nurse	Public General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—93

GUATEMALA DIVISION

Name	Title	Graduate of
N. P. Macphail, M.D.	Superintendent	Aberdeen University, Aberdeen, Scotland
K. P. A. Taylor, M.D., B.S.	Surgeon	University of Pennsylvania School of Medicine, Philadelphia, Pa.
R. Aguilar, M.D., D.D.S.	Surgeon	Universidad Central, Tegucigalpa, Honduras,—Strycher Dental School, New York, N. Y.
G. R. Harrod, M.D.	Physician	University of Louisville School of Medicine, Louisville, Ky.
L. R. Mathews	Laboratory Technician	
Myra Ellerby, R.N.	Matron	Middlesex Hospital, London, England
Johanna M. Brosnan, R.N.	Assistant Matron	Hospital St. John & Elizabeth, London, England
Katharine L. Hamilton, R.N.	Nurse	Eastern Maine Hospital, Bangor, Me.
Margaret A. Storrow, R.N.	Nurse	Cumberland Infirmary, Carlisle, England
Nina Pendleton, R.N.	Nurse	Liverpool Royal Infirmary, Liverpool, England
Carmen Mendez, R.N.	Nurse	Hospital Americano, Guatemala City, Guatemala
Maria Martinez, R.N.	Nurse	Hospital Americano, Guatemala City, Guatemala
Gabriela Solares, R.N.	Nurse	Hospital Americano, Guatemala City, Guatemala

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—94

JAMAICA DIVISION

Name	Title	Graduate of
I. W. McLean, M.D., F.A.C.S.	Superintendent	University of Maryland, Baltimore, Md.
J. G. Moseley, M.D., B.S., M.R.C.S., L.R.C.P.	District Physician	University of London, England
C. A. Moseley, M.D.	District Physician	University College Hospital Medical School, London, England
F. R. Evans, M.D.	District Physician	Bellevue Hospital Medical College, New York, N. Y.
A. C. Lushington, L.R.C.S., L.F.P. and S.	District Physician	University of Edinburgh and Glasgow, Scotland
TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—18		

PANAMA DIVISION

Name	Title	Graduate of
O. T. Brosius, M.D., D.T.M. and H., F.A.C.P.	Superintendent	Tufts College Medical School, Boston, Mass. London School of Tropical Medicine, London, England
E. Thonnard-Neumann, M.D.	Physician and Pathologist	University of Frankfort-on-the-Main, Germany
W. S. Dove, M.D., A.B.	Surgeon	University of Texas, Galveston, Texas
Mae A. Kenney, R.N.	Matron	Worcester City Hospital, Worcester, Mass.
Clara Totske, G.N.	Nurse	Hamburg-Eppendorf, Hamburg, Ger- many
TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—45		

PRESTON DIVISION

Name	Title	Graduate of
J. de la Guardia, M.D.	Superintendent	Jefferson Medical College, Philadelphia, Pa.
P. S. Malaret (Jr.), M.D.	District Medical Officer	Medico-Chirurgical College, Philadel- phia, Pa.
O. Ortiz, M.D.	Physician	Havana University, Havana, Cuba
J. C. Castellanos, M.D.	Physician	Tulane University, New Orleans, La.
W. Cordes, M.D.	Bacteriologist and Roent- genologist	Marburg University, Germany
Louisa Kurath, R.N.	Matron	M. E. Hospital, Philadelphia, Pa.
Violet E. Reams, R.N.	Nurse	New York Post-Graduate Medical School and Hospital, New York, N. Y.
Marie K. Falconer, R.N.	Nurse	New York Hospital, New York, N. Y.
Matilda L. Baiz, R.N.	Nurse	New York Post-Graduate Medical School and Hospital, New York, N. Y.
Margarita Hernandez, R.N.	Nurse	Santo Tomas Hospital Training School, Panama City, Panama
Catherine Clarke, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Helen Greenlees, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—52		

TELA RAILROAD COMPANY

Name	Title	Graduate of
R. B. Nutter, M.D.	Superintendent	Tufts College Medical School, Boston, Mass.
E. J. Whitaker, M.D.	Physician	University of Iowa, Iowa City, Iowa
A. E. Moure, M.D.	Physician	Sorbonne Medical School, Paris, France
G. Izaguirre, M.D.	Physician	Syracuse Medical School, Syracuse, N. Y.
J. C. McDaniel	Bacteriologist	
Bessie M. Stringer, R.N.	Matron	Charity Hospital, New Orleans, La.
Hilda Hartman, R.N.	Nurse	Schassburg Hospital, Siebengurgen, Germany
Elisabeth Sommer, R.N.	Nurse	Universitats Klinik, Leipzig, Germany
Lilla Maud Peart, G.N.	Nurse	Public General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—72

TRUXILLO RAILROAD COMPANY

Name	Title	Graduate of
B. M. Phelps, M.D.	Superintendent	Vanderbilt University, Nashville, Tenn.
W. A. Hutchinson, M.D.	Assistant Surgeon	Tulane University, New Orleans, La.
W. Jantzen, M.D.	Bacteriologist	University of Kiel, Germany
L. R. Fletcher, M.D., A.B.	Physician	Rush Medical College of University of Chicago, Chicago, Ill.
Gena H. Robertson, R.N.	Matron	Sarah Leigh Hospital, Norfolk, Va.
Madolin P. Johnson, R.N.	Nurse	Roosevelt Hospital, New York, N. Y.
America Ferrera, G.N.	Nurse	D'Antoni Hospital, La Ceiba, Honduras
Julia Rodriguez, G.N.	Nurse	D'Antoni Hospital, La Ceiba, Honduras
Sylvia Haylock, G.N.	Nurse	D'Antoni Hospital, La Ceiba, Honduras

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS, REGISTERED NURSES, AND LABORATORY TECHNICIANS—75

SUMMARY OF WORK DONE

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	M.	F.	M.	F.	M.	F.	M.	F.
PERSONS DEPENDENT UPON THE MEDICAL DEPARTMENT FOR TREATMENT:								
Employees:								
From Temperate Zone	358	11	109	9	254	17	246	9
Others	4,793	102	7,705	302	5,856	259	4,351	123
Non-employees:								
From Temperate Zone	957	460	550	346	59	100	277	237
Others	10,385	12,687	7,958	8,061	2,720	4,017	6,920	5,436
Totals:								
Employees	T. 369	O. 4,895	T. 118	O. 8,007	T. 271	O. 6,115	T. 255	O. 4,474
Non-employees	1,417	23,072	896	16,019	159	6,737	514	12,356
TOTAL	1,786	27,967	1,014	24,026	430	12,852	769	16,830
Passengers on steamships	-	-	-	-	-	-	-	-
Officers, crews and ships' laborers	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-
GRAND TOTAL	-	-	-	-	-	-	-	-
PATIENTS TREATED IN HOSPITALS:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	66	3	94	1	133	2	194	4
Others	1,189	12	2,886	104	3,089	100	1,713	50
Non-employees:								
From Temperate Zone	11	10	41	19	85	26	118	5
Others	137	330	184	336	811	654	834	32
Totals:								
Employees	T. 69	O. 1,201	T. 95	O. 2,990	T. 135	O. 3,189	T. 197	O. 1,764
Non-employees	21	467	60	520	111	1,465	171	1,157
GRAND TOTAL	90	1,668	155	3,510	246	4,654	368	2,921
TREATMENTS IN HOSPITAL DISPENSARIES:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	1,254	18	91	2	620	3	770	3
Others	17,563	177	16,215	382	13,644	385	3,817	18
Non-employees:								
From Temperate Zone	269	487	86	53	238	104	319	16
Others	4,944	8,201	1,140	2,371	1,519	2,017	1,004	41
Totals:								
Employees	T. 1,272	O. 17,740	T. 93	O. 16,597	T. 623	O. 14,029	T. 800	O. 4,000
Non-employees	756	13,145	139	3,511	342	3,536	483	1,411
GRAND TOTAL	2,028	30,885	232	20,108	965	17,565	1,283	5,411
TREATMENT IN FIELD DISPENSARIES:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	-	-	177	-	79	-	798	1
Others	-	-	28,877	871	5,247	242	14,972	35
Non-employees:								
From Temperate Zone	-	-	-	-	-	1	147	15
Others	-	-	48	124	49	149	1,540	1,25
Totals:								
Employees	T. -	O. -	T. 177	O. 29,748	T. 79	O. 5,489	T. 815	O. 15,33
Non-employees	-	-	-	172	1	198	298	2,79
GRAND TOTAL	-	-	177	29,920	80	5,687	1,113	18,12

AND VITAL STATISTICS

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi-Total		Total
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
94	4	110	7	297	12	280	12	247	8	1,995	89	2,084
9,850	2,087	2,347	226	5,337	165	5,363	109	4,423	122	50,025	3,495	53,520
46	69	7	29	139	133	27	68	35	65	2,097	1,507	3,604
4,925	7,388	1,381	1,669	3,145	4,034	749	1,523	768	1,683	38,951	46,498	85,449
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
98	11,937	117	2,573	309	5,502	292	5,472	255	4,545	2,084	53,520	55,604
115	12,313	36	3,050	272	7,179	95	2,272	100	2,451	3,604	85,449	89,053
213	24,250	153	5,623	581	12,681	387	7,744	355	6,996	5,688	138,969	144,657
-	-	-	-	-	-	-	-	-	-	-	-	57,592
-	-	-	-	-	-	-	-	-	-	-	-	31,726
-	-	-	-	-	-	-	-	-	-	-	-	89,318
-	-	-	-	-	-	-	-	-	-	-	-	233,975
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
11	-	106	4	125	1	151	7	165	9	1,045	30	1,075
9	3	1,395	110	1,280	22	3,128	43	2,308	57	16,997	501	17,498
7	5	7	29	28	16	86	85	43	19	426	262	688
-	3	255	525	134	299	386	973	282	613	3,023	4,056	7,079
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
11	12	110	1,505	126	1,302	158	3,171	174	2,365	1,075	17,498	18,573
12	3	36	780	44	433	171	1,359	62	895	688	7,079	7,767
23	15	146	2,285	170	1,735	329	4,530	236	3,260	1,763	24,577	26,340
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
493	3	883	87	1,247	-	1,054	83	1,272	93	7,684	319	8,003
3,493	561	7,767	1,042	9,829	305	10,511	269	5,207	274	88,046	3,580	91,626
436	194	74	423	159	237	570	955	181	302	2,332	2,919	5,251
1,014	1,082	1,664	3,475	2,410	3,922	1,428	3,062	918	1,917	16,041	26,457	42,498
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
496	4,054	970	8,809	1,247	10,134	1,137	10,780	1,365	5,481	8,003	91,626	99,629
630	2,096	497	5,139	396	6,332	1,525	4,490	483	2,835	5,251	42,498	47,749
1,126	6,150	1,467	13,948	1,643	16,466	2,662	15,270	1,848	8,316	13,254	134,124	147,378
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
270	-	150	-	-	-	491	-	91	-	2,056	17	2,073
4,904	4,812	8,394	991	-	-	16,586	120	5,102	32	94,082	7,426	101,508
5	17	9	21	-	-	5	5	-	-	166	195	361
999	1,109	200	1,103	-	-	326	796	125	254	3,287	4,790	8,077
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
270	19,716	150	9,385	-	-	491	16,706	91	5,134	2,073	101,508	103,581
22	2,108	30	1,303	-	-	10	1,122	-	379	361	8,077	8,438
292	21,824	180	10,688	-	-	501	17,828	91	5,513	2,434	109,585	112,019

SUMMARY OF WORK DONE

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	M.	F.	M.	F.	M.	F.	M.	F.
TOTAL NUMBER OF TREATMENTS IN HOSPITAL AND FIELD DISPENSARIES:								
Employees:								
From Temperate Zone	1,254	18	268	2	699	3	1,568	4
Others	17,563	177	45,092	1,253	18,891	627	18,789	54
Non-employees:								
From Temperate Zone	269	487	86	53	238	105	466	31
Others	4,944	8,201	1,188	2,495	1,568	2,166	2,544	1,66
Totals:								
Employees	1,272	17,740	270	46,345	702	19,518	1,615	19,33
Non-employees	756	13,145	139	3,683	343	3,734	781	4,20
GRAND TOTAL	2,028	30,885	409	50,028	1,045	23,252	2,396	23,54
NUMBER OF HOSPITAL DAYS:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	744	23	944	25	1,469	9	1,711	2
Others	15,075	114	37,356	1,218	43,794	984	14,759*	84
Non-employees:								
From Temperate Zone	135	71	645	266	1,482	305	1,500	70
Others	1,649	2,582	2,485	3,713	13,535	8,002	13,189	3,56
Totals:								
Employees	767	15,189	969	38,574	1,478	44,778	1,734	15,63
Non-employees	206	4,231	911	6,198	1,787	21,537	2,205	16,77
GRAND TOTAL	973	19,420	1,880	44,772	3,265	66,315	3,939	32,39
NUMBER OF TREATMENTS ABOARD PASSENGER STEAM-SHIPS								
	-	-	-	-	-	-	-	-
NUMBER OF TREATMENTS BY PORT MEDICAL OFFICERS								
	-	-	-	-	-	-	-	-
NUMBER OF SEAMEN AND APPLICANTS EXAMINED BY PORT MEDICAL OFFICERS								
	-	-	-	-	-	-	-	-
DEATHS, HOSPITALS:								
Employees:								
From Temperate Zone	1	-	-	-	1	-	1	-
Others	31	-	50	-	85	-	49	-
Non-employees:								
From Temperate Zone	-	-	1	-	1	-	2	-
Others	25	-	28	-	67	-	37	-
Total:								
Employees	32	-	50	-	86	-	50	-
Non-employees	25	-	29	-	68	-	39	-
GRAND TOTAL	57	-	79	-	154	-	89	-
DEATHS, HOSPITAL DISPENSARIES:								
Employees:								
From Temperate Zone	-	-	-	-	-	-	-	-
Others	5	-	1	-	3	-	-	-
Non-employees:								
From Temperate Zone	-	-	-	-	-	-	-	-
Others	-	-	-	-	2	-	-	-
Total:								
Employees	5	-	1	-	3	-	-	-
Non-employees	-	-	-	-	2	-	-	-
GRAND TOTAL	5	-	1	-	5	-	-	-

* Including 1,032 days in Bobos Sick Camp.

ND VITAL STATISTICS—Continued

[illegible]

SUMMARY OF WORK DONE

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	M.	F.	M.	F.	M.	F.	M.	F.
DEATHS, FIELD DISPENSARIES:								
Employees:								
From Temperate Zone	-	-	-	-	-	-	-	-
Others	-	-	2	-	-	-	-	-
Non-employees:								
From Temperate Zone	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-
TOTAL:								
Employees	-	-	2	-	-	-	-	-
Non-employees	-	-	-	-	-	-	-	-
GRAND TOTAL	-	-	2	-	-	-	-	-
DEATHS, HOSPITALS AND ALL DISPENSARIES COMBINED:								
Employees:								
From Temperate Zone	1	-	-	1	1	1	1	1
Others	36	53	88	49				
Non-employees:								
From Temperate Zone	-	1	1	2				
Others	25	28	69	37				
Total:								
Employees	37	53	89	50				
Non-employees	25	29	70	39				
GRAND TOTAL	62	82	159	89				
DEATHS, STEAMSHIP SERVICE:								
Passengers	-	-	-	-	-	-	-	-
Officers, crews and ships' laborers	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-
GRAND TOTAL—DEATHS AMONG PATIENTS TREATED: (Steamship service included)	-	-	-	-	-	-	-	-
AVERAGE DAILY NUMBER OF PATIENTS IN HOSPITALS:								
Employees:								
From Temperate Zone	2.10	2.66	4.06	4.76				
Others	41.73	105.97	123.01	42.90				
Non-employees:								
From Temperate Zone . . . . .	.57	2.50	4.91	6.06				
Others	11.62	17.03	59.17	46.04				
Total:								
Employees	43.83	108.63	127.07	47.66				
Non-employees	12.19	19.53	64.08	52.10				
GRAND TOTAL	56.02	128.16	191.15	99.76				
AVERAGE DAILY NUMBER OF TREATMENTS IN HOSPITAL DISPENSARIES AND FIELD DISPENSARIES:								
Employees:								
From Temperate Zone	3.49	.74	1.93	4.44				
Others	48.74	127.32	53.62	53.11				
Non-employees:								
From Temperate Zone	2.08	.38	.94	2.15				
Others	36.11	10.12	10.26	11.56				
Total:								
Employees	52.23	128.06	55.55	57.55				
Non-employees	38.19	10.50	11.20	13.71				
GRAND TOTAL	90.42	138.56	66.75	71.26				

AND VITAL STATISTICS—Continued

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi-Total		Total
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
—	—	—	—	—	—	—	—	—	—	—	—	—
13	—	—	—	—	—	2	—	—	—	—	—	17
—	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	4	—	—	—	—	—	13
13	—	—	—	—	—	2	—	—	—	—	—	17
9	—	—	—	—	—	4	—	—	—	—	—	13
—	—	—	—	—	—	—	—	—	—	—	—	—
22	—	—	—	—	—	6	—	—	—	—	—	30
—	—	—	—	5	—	1	—	3	—	—	—	12
17	43	40	—	40	—	70	—	63	—	—	—	459
2	—	—	—	—	—	3	—	5	—	—	—	14
9	26	57	—	57	—	47	—	47	—	—	—	345
17	43	45	—	45	—	71	—	66	—	—	—	471
11	26	57	—	57	—	50	—	52	—	—	—	359
—	—	—	—	—	—	—	—	—	—	—	—	—
28	69	102	—	102	—	121	—	118	—	—	—	830
—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	5
—	—	—	—	—	—	—	—	—	—	—	—	8
—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	838
.64	3.01	4.18	—	4.18	—	3.78	—	6.40	—	—	—	31.60
.31	61.66	41.37	—	41.37	—	110.27	—	77.80	—	—	—	605.04
.38	.82	.99	—	.99	—	4.53	—	2.87	—	—	—	23.62
.11	22.25	12.76	—	12.76	—	33.02	—	23.45	—	—	—	225.45
.95	64.67	45.55	—	45.55	—	114.05	—	84.20	—	—	—	636.64
.49	23.07	13.75	—	13.75	—	37.55	—	26.32	—	—	—	249.07
—	—	—	—	—	—	—	—	—	—	—	—	—
1.44	87.74	59.30	—	59.30	—	151.60	—	110.52	—	—	—	885.71
2.10	3.08	3.43	—	3.43	—	4.47	—	4.00	—	—	—	27.68
65.30	49.98	27.84	—	27.84	—	75.51	—	29.16	—	—	—	530.59
1.79	1.45	1.08	—	1.08	—	4.21	—	1.33	—	—	—	15.42
11.55	17.70	17.40	—	17.40	—	15.42	—	8.83	—	—	—	138.94
67.40	53.06	31.27	—	31.27	—	79.98	—	33.16	—	—	—	558.27
13.34	19.15	18.48	—	18.48	—	19.63	—	10.16	—	—	—	154.36
—	—	—	—	—	—	—	—	—	—	—	—	—
80.74	72.21	49.75	—	49.75	—	99.61	—	43.32	—	—	—	712.63

SUMMARY OF WORK DONE

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	M.	F.	M.	F.	M.	F.	M.	F.
DEATH RATE PER THOUSAND PERSONS DEPENDENT ON THE COMPANY FOR TREATMENT (Steamship em- ployees and passengers not included):								
Employees:								
From Temperate Zone	2.71		-		3.69		3.92	
Others	7.35		6.62		14.39		10.95	
Non-employees:								
From Temperate Zone	-		1.12		6.29		3.89	
Others	1.08		1.75		10.24		2.99	
Total:								
Employees	7.03		6.52		13.94		10.57	
Non-employees	1.02		1.71		10.16		3.03	
GRAND TOTAL	2.08		3.27		11.97		5.06	
REPATRIATIONS:								
Employees:								
From Temperate Zone	-		-		-		-	
Others	2		37		2		-	
Non-employees:								
From Temperate Zone	-		-		-		-	
Others	-		-		-		-	
Total:								
Employees	2		37		2		-	
Non-employees	-		-		-		-	
GRAND TOTAL	2		37		2		-	
AVERAGE NUMBER OF HOSPITAL DAYS ANNUALLY, PER EMPLOYEE:								
From Temperate Zone	2.08		8.21		5.45		6.80	
Others	3.10		4.82		7.32		3.49	
TOTAL	3.03		4.87		7.24		3.67	
HOSPITAL ADMISSION RATE ANNUALLY, PER THOUSAND EMPLOYEES:								
From Temperate Zone	187		805		498		773	
Others	245		373		522		394	
TOTAL	241		380		521		414	
AVERAGE NUMBER DISPENSARY TREATMENTS ANNUALLY, PER EMPLOYEE:								
From Temperate Zone	3.45		2.29		2.59		6.33	
Others	3.62		5.79		3.19		4.32	
TOTAL	3.61		5.74		3.17		4.43	
AVERAGE NUMBER OF EMPLOYEES NON-EFFECTIVE, PER THOUSAND EMPLOYEES:								
From Temperate Zone	5.69		22.54		14.98		18.67	
Others	8.53		13.23		20.12		9.59	
TOTAL	8.33		13.37		19.90		10.08	
AVERAGE NUMBER OF EMPLOYEES PARTIALLY NON- EFFECTIVE PER THOUSAND EMPLOYEES:								
From Temperate Zone	9.46		6.27		7.12		17.41	
Others	9.96		15.90		8.77		11.87	
TOTAL	9.92		15.76		8.70		12.17	

AND VITAL STATISTICS—Concluded

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi- Total		Total
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
-	-	-	-	16.18	-	3.42	-	11.76	-	-	-	5.76
1.42	-	16.71	-	7.27	-	12.79	-	13.86	-	-	-	8.58
17.39	-	-	-	-	-	31.58	-	50.00	-	-	-	3.88
.73	-	8.52	-	7.94	-	20.69	-	19.18	-	-	-	4.04
1.41	-	15.99	-	7.74	-	12.32	-	13.75	-	-	-	8.47
.89	-	8.43	-	7.65	-	21.12	-	20.38	-	-	-	4.03
1.14	-	11.95	-	7.69	-	14.88	-	16.05	-	-	-	5.74
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	5	-	7	-	16	-	1	-	-	-	70
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	2	-	2	-	-	-	-	-	-	-	4
-	-	5	-	7	-	16	-	1	-	-	-	70
-	-	2	-	2	-	-	-	-	-	-	-	4
-	-	7	-	9	-	16	-	1	-	-	-	74
2.37	-	9.38	-	4.92	-	4.71	-	9.14	-	-	-	5.52
.01	-	8.72	-	2.74	-	7.33	-	6.23	-	-	-	4.11
.03	-	8.75	-	2.85	-	7.20	-	6.39	-	-	-	4.17
112	-	940	-	408	-	541	-	682	-	-	-	516
1	-	585	-	237	-	579	-	520	-	-	-	327
2	-	600	-	246	-	578	-	529	-	-	-	934
7.82	-	9.57	-	4.04	-	5.58	-	5.71	-	-	-	4.83
1.99	-	7.07	-	1.84	-	5.02	-	2.34	-	-	-	3.61
2.04	-	7.18	-	1.96	-	5.05	-	2.51	-	-	-	3.65
6.53	-	25.73	-	13.53	-	12.95	-	25.10	-	-	-	15.16
.03	-	23.96	-	7.52	-	20.15	-	17.12	-	-	-	11.30
.08	-	24.04	-	7.84	-	19.79	-	17.54	-	-	-	11.45
21.43	-	26.32	-	11.10	-	15.31	-	15.69	-	-	-	13.28
5.47	-	19.42	-	5.06	-	13.80	-	6.42	-	-	-	9.91
5.60	-	19.72	-	5.38	-	13.88	-	6.91	-	-	-	10.04

RECORD OF

			Banes Division		Colombia Division		Costa Rica Division	
			T.	O.	T.	O.	T.	O.
Remaining from last year	{	Emp. { M.	6	14	1	95	4	96
		Non-emp. { F.	-	-	-	5	-	2
		Non-emp. { M.	-	3	1	3	4	30
	{	Non-emp. { F.	-	5	-	10	1	23
		Emp. { M.	60	1,175	93	2,791	129	2,993
		Non-emp. { F.	3	12	1	99	2	98
Admitted this year	{	Non-emp. { M.	11	134	40	181	81	781
		Non-emp. { F.	10	325	19	326	25	631
		Emp. { M.	65	1,159	91	2,810	131	2,994
Discharged	{	Non-emp. { F.	3	12	1	104	2	97
		Non-emp. { M.	11	134	41	176	80	780
		Non-emp. { F.	10	327	18	332	25	641
Remaining	{	Emp. { M.	1	30	3	76	2	95
		Non-emp. { F.	-	-	-	-	-	3
		Non-emp. { M.	-	3	-	8	5	31
	{	Non-emp. { F.	-	3	1	4	1	13
		Emp. { M.	1	31	-	50	1	85
		Non-emp. { F.	-	25	1	28	-	67
Died	{	Non-emp. { M.	-	2	-	37	-	2
		Non-emp. { F.	-	-	-	-	-	-
		Non-emp. { M.	-	-	-	-	-	-
Repatriated	{	Non-emp. { F.	-	-	-	-	-	-
		Non-emp. { M.	-	-	-	-	-	-
		Non-emp. { F.	-	-	-	-	-	-
Total number of hospital days	{	Emp. { M.	744	15,075	944	37,356	1,469	43,794
		Non-emp. { F.	23	114	25	1,218	9	984
		Non-emp. { M.	135	1,649	645	2,485	1,482	13,535
	{	Non-emp. { F.	71	2,582	266	3,713	305	8,002
		Emp. { M.	3	47	3	34	11	111
		Non-emp. { F.	2	86	4	44	23	84
Operations with general anesthesia	{	Non-emp. { M.	5	386	22	1,868	165	4,936
		Non-emp. { F.	3	63	35	343	638	2,599
		Non-emp. { M.	-	-	-	-	-	-

HOSPITALS

Guatemala Division		Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Total		Grand Total
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
3	55	1	—	—	30	4	21	2	91	4	66	25	468	493
—	1	—	—	1	—	—	1	1	1	—	1	2	11	13
2	15	1	—	—	3	—	4	3	13	—	5	11	76	87
5	10	1	—	—	7	—	4	7	13	3	6	17	78	95
191	1,658	10	9	106	1,365	121	1,259	149	3,037	161	2,242	1,020	16,529	17,549
3	49	—	3	3	110	1	21	6	42	9	56	28	490	518
116	819	6	—	7	252	28	130	83	373	43	277	415	2,947	3,362
48	313	4	3	29	518	16	295	78	960	16	607	245	3,978	4,223
193	1,683	11	9	105	1,348	122	1,241	148	3,030	158	2,242	1,024	16,516	17,540
3	45	—	2	4	108	1	22	7	42	9	56	30	488	518
109	804	7	—	7	252	27	132	84	374	35	267	401	2,919	3,320
53	316	5	3	29	517	16	290	82	967	17	607	255	4,000	4,255
1	30	—	—	1	47	3	39	3	98	7	66	21	481	502
—	5	—	1	—	2	—	—	—	1	—	1	—	13	13
9	30	—	—	—	3	1	2	2	12	8	15	25	104	129
—	7	—	—	—	8	—	9	3	6	2	6	7	56	63
1	49	—	—	—	43	4	37	1	67	3	63	11	425	436
2	37	1	—	—	26	—	19	3	41	5	47	13	290	303
—	—	—	—	—	5	—	7	—	16	—	1	—	70	70
—	—	—	—	—	2	—	2	—	—	—	—	—	4	4
711	13,727	232	93	1,059	21,310	1,513	14,852	1,336	39,785	2,238	27,700	11,246	213,692	224,938
23	858	—	21	38	1,136	7	207	40	352	93	619	258	5,509	5,767
500	13,189	65	—	30	3,027	235	1,571	834	5,185	560	2,881	5,486	43,522	49,008
705	3,568	74	41	269	5,072	125	3,073	814	6,836	486	5,653	3,115	38,540	41,655
14	97	1	—	10	95	9	89	9	43	14	111	74	627	701
10	60	1	1	12	137	8	206	22	68	18	50	100	736	836
61	841	2	2	6	880	39	734	70	882	34	805	404	11,334	11,738
16	194	—	—	4	147	13	147	26	445	8	263	743	4,201	4,944

RECORD OF

		Banes Division		Colombia Division		Costa Rica Division	
		T.	O.	T.	O.	T.	O.
Number of treatments administered	Emp. { M.	1,254	17,563	91	16,215	620	13,644
	F.	18	177	2	382	3	385
	Non- { M.	269	4,944	86	1,140	238	1,519
	Emp. { F.	487	8,201	53	2,371	104	2,017
Patients sent to hospitals	Emp. { M.	60	1,175	80	759	88	1,994
	F.	3	12	1	26	2	69
	Non- { M.	11	134	40	175	80	762
	Emp. { F.	10	325	19	320	19	570
Visits to lodgings	Emp. { M.	137	370	6	112	45	213
	F.	4	2	-	1	1	49
	Non- { M.	57	305	37	1	5	22
	Emp. { F.	114	564	86	5	9	58
Operations with general anesthesia	Emp.	-	-	-	-	-	-
	Non-emp.	-	1	-	2	-	-
Operations with or without local anesthesia	Emp.	245	3,184	1	585	120	1,685
	Non-emp.	351	9,079	20	219	29	153
Died	Emp.	-	5	-	1	-	3
	Non-emp.	-	-	-	-	-	2
Repatriated	Emp.	-	-	-	-	-	-
	Non-emp.	-	-	-	-	-	-

HOSPITAL DISPENSARIES

[illegible]

RECORD OF

				Banes Division		Colombia Division		Costa Rica Division	
				T.	O.	T.	O.	T.	O.
Number of treatments administered	{	Emp.	{ M.	-	-	177	28,877	79	5,247
			{ F.	-	-	-	871	-	242
			{ M.	-	-	-	48	-	49
			{ F.	-	-	-	124	1	149
Number of surgical treatments	{	Emp.	{ M.	-	-	12,359		1,661	
			{ F.	-	-	223		10	
			{ M.	-	-	13		4	
			{ F.	-	-	18		6	
Number of medical treatments.	{	Emp.	{ M.	-	-	16,695		3,665	
			{ F.	-	-	648		232	
			{ M.	-	-	35		45	
			{ F.	-	-	106		144	
Total number of treatments				-	-	30,097		5,767	
Patients sent to hospitals	{	Emp.	{ M.	-	-	13	2,032	41	999
			{ F.	-	-	-	73	-	29
			{ M.	-	-	-	6	1	19
			{ F.	-	-	-	6	6	58
Visits to lodgings	{	Emp.	{ M.	-	-	395		424	
			{ F.	-	-	59		90	
			{ M.	-	-	1		15	
			{ F.	-	-	13		27	
Died	{	Emp.	{ M.	-	-	-	2	-	-
			{ F.	-	-	-	-	-	-
			{ M.	-	-	-	-	-	-
			{ F.	-	-	-	-	-	-

* NOTE.—The Banes Division and the Preston Division did not operate any Field Dispensaries during the year 1928.

FIELD DISPENSARIES

Guatemala Division		Jamaica Division		Panama Division		*Preston Division		Tela Railroad		Truxillo Railroad		Total		Grand Total
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
798	14,972	270	14,904	150	8,394	-	-	491	16,586	91	5,102	2,056	94,082	96,138
17	358	-	4,812	-	991	-	-	-	120	-	32	17	7,426	7,443
147	1,540	5	999	9	200	-	-	5	326	-	125	166	3,287	3,453
151	1,255	17	1,109	21	1,103	-	-	5	796	-	254	195	4,790	4,985
6,188		4,524		2,218		-		4,206		1,706				32,862
67		860		119		-		41		1				1,321
752		287		43		-		153		6				1,258
520		177		165		-		212		1				1,099
9,582		10,650		6,326		-		12,871		3,487				63,276
308		3,952		872		-		79		31				6,122
935		717		166		-		178		119				2,195
886		949		959		-		589		253				3,886
19,238		22,116		10,868		-		18,329		5,604				112,019
14	650	-	109	4	3,484	-	-	1	1,401	3	337	76	9,012	9,088
-	24	-	17	-	542	-	-	-	1	-	5	-	691	691
-	6	-	1	-	144	-	-	-	11	-	7	1	194	195
-	14	-	2	1	787	-	-	-	153	-	15	7	1,035	1,042
720		980		282		-		28		869				3,698
74		423		63		-		9		28				746
153		106		37		-		6		22				340
265		78		115		-		19		173				690
-	-	-	11	-	-	-	-	-	2	-	-	-	15	15
-	-	-	2	-	-	-	-	-	-	-	-	-	2	2
-	-	-	5	-	-	-	-	-	1	-	-	-	6	6
-	-	-	4	-	-	-	-	-	3	-	-	-	7	7

DEATHS BY AGE,

Age and Sex	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.		O.		T.		O.		T.		O.		T.		O.	
Under 1 year	M.	-	-	1	-	-	1	5	-	-	-	3	-	-	-	1
	F.	-	-	4	-	-	-	2	-	-	-	2	-	-	-	1
1 to 5 years	M.	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-
	F.	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
6 to 10 years	M.	-	-	1	-	-	-	-	-	-	-	-	-	-	-	4
	F.	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
11 to 20 years	M.	-	4	-	-	2	-	2	-	2	-	2	-	5	-	3
	F.	-	-	-	-	-	-	1	-	-	-	6	-	1	-	6
21 to 30 years	M.	-	17	-	-	22	-	2	-	19	-	4	-	27	-	6
	F.	-	-	5	-	3	-	4	-	-	-	12	-	-	-	3
31 to 40 years	M.	-	7	-	-	12	-	2	-	25	1	8	-	11	-	3
	F.	-	-	2	-	1	-	3	-	-	-	7	-	-	-	7
41 to 50 years	M.	1	4	-	2	8	-	2	1	16	-	6	-	2	-	1
	F.	-	-	3	-	-	-	2	-	-	-	2	-	-	-	1
51 to 60 years	M.	-	2	-	-	3	-	2	-	16	-	8	1	1	1	1
	F.	-	-	2	-	-	-	-	-	1	-	3	-	-	-	-
61 to 70 years	M.	-	2	-	-	-	-	-	-	6	-	2	-	1	-	-
	F.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Over 70 years	M.	-	-	-	-	1	-	-	-	2	-	2	-	-	1	-
	F.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Unknown . .	M.	-	-	-	-	1	-	-	-	1	-	-	-	1	-	-
	F.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL .	M.	1	36	-	6	-	49	1	16	1	87	1	35	1	48	2
	F.	-	-	-	19	-	4	-	12	-	1	-	34	-	1	-
GRAND TOTAL		1	36	-	25	-	53	1	28	1	88	1	69	1	49	2

NATIVITY AND SEX

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total				Total
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
-	-	-	-	-	-	-	1	-	-	-	6	-	-	1	3	-	-	-	5	-	-	2	25	27
-	-	-	1	-	-	-	1	-	-	-	6	-	-	-	4	-	-	-	1	-	-	-	22	22
-	-	-	5	-	-	-	-	-	-	-	7	-	-	-	9	-	-	-	3	-	-	-	27	27
-	-	-	3	-	-	-	2	-	-	-	6	-	-	-	3	-	-	-	1	-	-	-	17	17
-	-	-	-	-	-	-	-	-	-	-	4	-	1	-	1	-	-	-	-	-	1	-	10	11
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	3	3	
-	-	-	-	-	1	-	2	-	5	-	1	-	10	-	2	-	9	1	7	-	38	1	19	58
-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	2	-	-	-	3	-	1	-	21	22
-	5	1	-	-	4	-	1	1	12	-	3	-	36	-	3	-	27	1	4	1	169	2	23	195
-	1	-	-	-	-	-	4	-	-	-	7	-	-	-	4	-	-	-	7	-	4	-	46	50
-	5	-	-	-	7	-	-	1	13	-	2	-	16	-	-	1	14	-	3	2	110	1	18	131
-	1	-	-	-	-	-	2	-	-	-	4	-	-	1	6	-	-	-	7	-	2	1	38	41
-	2	1	-	-	14	-	-	2	2	-	1	-	6	-	2	1	9	3	1	5	63	4	15	87
-	-	-	-	-	-	-	7	-	-	-	4	-	-	-	1	-	-	-	1	-	-	-	21	21
-	1	-	-	-	10	-	1	-	6	-	2	1	1	-	1	1	2	-	2	3	42	1	17	63
-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	-	-	-	2	-	1	-	10	11
-	1	-	-	-	5	-	1	1	2	-	1	-	-	-	1	-	-	-	-	1	17	-	5	23
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	3	3
-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	2	9
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	2	-	-	-	5	1	2	8
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	15	2	5	-	43	-	6	5	40	-	27	1	70	2	24	3	63	5	25	12	451	13	163	639
-	2	-	4	-	-	-	20	-	-	-	30	-	-	1	23	-	-	-	22	-	8	1	182	191
-	17	2	9	-	43	-	26	5	40	-	57	1	70	3	47	3	63	5	47	12	459	14	345	830

DEATHS BY NATIVITY

NATIVITY:	Banes Divi- sion	Colom- bia Divi- sion	Costa Rica Divi- sion	Guate- mala Divi- sion	Jamaica Divi- sion	Pan- ama Divi- sion	Preston Divi- sion	Tela Rail- road	Trux- illo Rail- road	Total
Australia	-	-	-	-	-	-	-	1	-	1
Barbados	1	-	3	-	-	-	-	1	-	5
British Honduras	-	-	1	2	-	-	-	2	8	13
British West Indies (other than Jamaica and Barbados)	-	-	3	-	-	4	1	-	2	10
China	2	-	1	-	-	-	1	-	-	4
Colombia	-	78	1	-	-	1	-	-	-	80
Costa Rica	-	-	58	-	-	5	-	1	1	65
Cuba	27	3	-	-	-	1	42	-	-	73
England	-	-	-	-	1	-	-	-	-	1
France	-	-	-	-	-	-	-	-	1	1
French West Indies	-	-	1	-	-	-	-	-	-	1
Guatemala	-	-	1	51	-	-	-	1	1	54
Haiti	24	-	-	-	-	-	27	-	-	51
Honduras	-	-	1	9	-	-	-	90	76	176
India	-	-	1	3	1	-	-	-	-	5
Jamaica	6	-	64	5	25	37	24	7	5	173
Mexico	-	-	-	1	-	-	-	1	-	2
Nicaragua	-	-	19	-	-	2	-	1	4	26
Norway	-	-	-	-	1	-	-	-	1	2
Palestine	-	-	-	-	-	-	-	2	-	2
Panama	-	-	2	-	-	18	-	-	-	20
Porto Rico	-	-	-	-	-	-	2	-	-	2
Salvador	-	-	-	14	-	1	-	12	11	38
Spain	1	-	2	-	-	-	4	1	-	8
United States	-	1	-	3	-	-	1	-	6	11
United States West Indies	1	-	1	-	-	-	-	-	-	2
Unknown	-	-	-	1	-	-	-	1	2	4
TOTAL	62	82	159	89	28	69	102	121	118	830

CLASSIFICATION OF DEATHS

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.
	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.
GENERAL DISEASES NOT INCLUDED ABOVE—								
Continued								
Anemia, Chlorosis:								
Pernicious anemia	-	-	-	-	-	-	1	-
Other anemias and chlorosis	-	-	-	-	-	-	1	-
Disease of the spleen	-	-	-	-	-	-	-	-
Alcoholism (acute or chronic)	-	-	-	-	-	-	1	-
Other general diseases:								
Acidosis	-	-	-	-	1	-	-	-
DISEASES OF THE NERVOUS SYSTEM AND OF THE								
ORGANS OF SPECIAL SENSE:								
Encephalitis	-	-	-	-	1	-	-	-
Meningitis:								
Simple	-	-	1	1	-	1	3	1
Non-epidemic cerebrospinal meningitis	-	-	-	1	-	-	-	1
Cerebral hemorrhage, apoplexy:								
Cerebral hemorrhage	-	2	1	-	1	2	1	-
Paralysis (without specified cause):								
Hemiplegia	-	-	-	1	2	1	-	-
Other forms of paralysis	-	-	-	-	1	-	-	-
General paralysis (of the insane)	-	-	-	-	-	1	-	-
Other forms of mental alienation	-	-	1	-	-	-	-	-
Epilepsy	-	-	1	-	1	-	-	-
Convulsions (non-puerperal) (5 years and over)	-	-	-	-	-	-	-	-
Infantile convulsions (under 5 years of age)	-	-	-	-	-	-	-	-
Other diseases of the nervous system	-	-	-	-	-	-	-	1
Diseases of the organs of hearing and the								
mastoid process:								
Diseases of the mastoid process	-	-	-	-	-	-	-	-
DISEASES OF THE CIRCULATORY SYSTEM:								
Pericarditis	-	-	-	-	1	-	-	-
Acute endocarditis and myocarditis:								
Acute endocarditis	-	-	-	-	-	-	-	-
Acute myocarditis	-	-	-	-	1	-	-	-
Other diseases of the heart:								
Chronic endocarditis	-	1	-	-	1	-	-	-
Chronic myocarditis	-	1	-	1	8	7	1	2
Other chronic diseases of the heart	-	1	1	3	4	4	-	-
Aneurism	-	-	-	-	1	-	-	-
Atheroma and other diseases of the arteries	-	-	-	-	-	-	1	-
Embolism and thrombosis (except cerebral)	-	-	-	-	-	-	-	-
Hemorrhage without determined cause; other								
diseases of the circulatory system	-	-	-	1	-	-	-	-
DISEASES OF THE RESPIRATORY SYSTEM:								
Diseases of the larynx (except tuberculosis and								
cancer)	-	-	-	-	-	-	-	-
Bronchitis:								
Acute	-	-	-	-	-	-	-	-
Chronic	-	-	-	-	-	-	-	-
Bronchopneumonia (including capillary								
bronchitis):								
Bronchopneumonia	-	6	5	3	2	5	1	2
Capillary bronchitis	-	-	-	-	-	-	-	-
Pneumonia:								
Lobar	-	6	-	8	-	21	11	19
Not otherwise specified	-	-	-	-	-	2	5	-
Pleurisy:								
Empyema of thoracic cavity	-	-	-	-	-	-	-	-
Gangrene of the lung	-	1	-	1	-	-	-	-

CLASSIFICATION OF DEATHS

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.
	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.
DISEASES OF THE RESPIRATORY SYSTEM—								
Continued								
Other diseases of the respiratory system (tuberculosis excepted):								
Others	-	-	-	-	-	-	-	-
DISEASES OF THE DIGESTIVE SYSTEM:								
Diseases of the pharynx and tonsils (including adenoids):								
Streptococcic sore throat	-	-	-	-	-	-	-	-
Ludwig's angina	-	-	-	-	-	-	-	-
Others	-	-	1	1	-	-	-	-
Diseases of the esophagus	-	-	-	-	-	-	-	-
Other diseases of the stomach (cancer excepted):								
Gastritis	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-
Diarrhea and enteritis (under 2 years of age)	-	-	1	1	-	-	-	-
Diarrhea and enteritis (2 years and over)	-	-	2	-	-	-	-	-
Parasites not specified	-	-	-	-	-	-	-	-
Appendicitis and typhlitis	-	1	-	-	-	-	-	-
Hernia, intestinal obstruction:								
Hernia	-	-	-	-	-	-	-	-
Intestinal obstruction	-	-	2	1	1	-	1	-
Other diseases of the intestines:								
Others	-	-	-	-	-	-	-	-
Cirrhosis of the liver:								
Returned as alcoholic	-	-	-	-	1	-	-	-
Not returned as alcoholic	-	-	3	-	-	1	-	-
Biliary calculi	-	-	-	-	-	-	-	-
Other diseases of the liver:								
Abscess of the liver, amebic	-	-	-	-	-	-	-	-
Other diseases of the liver	-	1	1	-	-	-	-	-
Peritonitis of unstated cause	-	1	-	1	2	3	-	-
NON-VENEREAL DISEASES OF THE GENITOURINARY SYSTEM AND ITS ADNEXA:								
Acute nephritis (including unspecified under 10 years of age)	-	-	1	1	1	-	-	-
Chronic nephritis (including unspecified over 10 years of age)	-	1	2	-	3	4	1	1
Other diseases of the kidneys and their adnexa (diseases of the kidney in pregnancy not included)	-	-	2	-	1	1	-	-
Diseases of the bladder (except tumors)	-	-	-	-	-	-	-	-
Diseases of the urethra, urinary abscess, etc.:								
Stricture of the urethra	-	-	-	-	-	-	-	-
Salpingitis or pelvic abscess	-	-	-	-	-	-	-	-
Benign tumors of the uterus	-	-	-	-	-	-	-	-
Other diseases of the female genital organs	-	-	-	-	-	-	-	1
THE PUERPERAL STATE:								
Puerperal hemorrhage	-	-	1	2	-	-	-	-
Other accidents of childbirth:								
Others	-	-	1	1	-	-	-	-
Puerperal septicemia	-	-	1	-	-	1	-	-
Puerperal albuminuria or convulsions	-	-	-	1	-	-	-	-
Childbirth (without other explanation)	-	-	-	-	-	-	-	-
DISEASES OF THE SKIN AND OF THE CELLULAR TISSUE:								
Gangrene	-	-	1	-	1	1	-	-

BY DISEASE—Continued

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi-total		Total	Deaths in Hospitals	
Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.		Emp.	Non-Emp.
T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.		T. O.	T. O.
-	-	-	-	-	-	-	-	-	1	-	1	1	-	1
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
-	1	-	-	-	-	-	-	-	-	-	1	1	-	-
-	-	-	1	-	-	-	-	-	-	-	1	1	-	1
-	-	-	1	-	-	-	-	-	-	2	1	3	2	1
-	-	-	1	-	-	-	-	-	-	-	1	1	-	1
-	1	-	-	-	-	-	-	-	-	1	-	1	-	-
-	-	-	-	1	-	-	1	-	-	1	1	2	1	1
-	4	-	-	-	6	-	1	-	-	2	11	13	-	2
-	1	-	-	-	1	-	-	1	-	3	2	5	2	1
-	-	-	-	-	-	-	-	1	-	1	-	1	1	-
-	-	-	2	-	-	-	-	1	-	3	1	4	3	1
-	-	-	1	-	-	-	-	-	-	1	-	1	1	-
-	-	-	1	-	-	-	-	-	-	2	4	6	2	4
-	-	-	-	-	1	-	-	-	-	-	1	1	-	1
-	-	-	-	-	-	1	-	-	-	2	-	2	1	-
-	-	-	1	-	1	2	-	-	-	5	3	8	5	3
-	-	-	1	-	-	-	-	-	-	-	1	1	-	1
-	-	-	-	-	-	-	-	1	1	1	1	2	1	1
-	-	-	-	-	-	-	-	-	-	1	1	2	1	1
-	1	-	-	-	2	1	1	1	1	5	8	14	4	8
-	-	-	-	-	-	-	-	-	-	-	-	9	3	5
-	2	-	-	-	4	-	3	-	1	16	9	25	14	9
-	-	-	-	-	1	-	-	-	-	3	2	5	3	2
-	-	-	1	-	-	-	-	-	-	1	-	1	1	-
-	-	-	-	-	1	-	-	-	-	1	-	1	1	-
-	-	-	-	-	-	-	-	1	-	-	1	1	-	1
-	-	-	-	-	-	-	-	-	1	-	1	1	-	1
-	-	-	-	-	-	-	-	-	-	-	4	4	-	3
-	-	-	-	-	-	-	1	-	-	-	3	3	-	3
-	-	-	-	-	-	-	1	-	-	1	2	4	1	2
-	-	-	1	-	-	-	-	-	2	-	4	4	-	4
-	-	-	-	-	-	-	1	-	-	-	1	1	-	1
-	-	-	-	-	-	-	-	-	-	1	2	3	1	2

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.
	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.
DISEASES OF THE SKIN AND OF THE CELLULAR TISSUE—Continued								
Boil, carbuncle, furuncle	-	-	-	-	-	-	-	-
Phlegmon, acute abscess	-	-	-	-	-	-	-	-
Other diseases of the skin and its adnexa:								
Other disease of the skin and adnexa	-	-	-	-	-	-	-	-
MALFORMATIONS:								
Congenital malformations (still-births ex- cepted):								
Others	-	-	-	-	1	-	-	-
DISEASES OF EARLY INFANCY:								
Congenital debility, icterus and sclerema:								
Marasmus	-	-	-	-	-	-	1	-
Inanition	-	-	-	-	-	-	1	-
Others	-	-	-	-	-	-	-	-
Premature birth, or consequence of labor:								
Premature birth	-	-	-	-	2	-	3	-
Other diseases peculiar to early infancy:								
Others	-	-	-	-	-	-	-	-
OLD AGE:								
Old age (senility)	-	-	-	-	-	2	1	-
EXTERNAL CAUSES:								
Suicide—(pistol)	-	-	-	-	-	-	-	-
Poisoning by venomous animals	-	-	-	-	-	-	1	-
Burns and scalds	-	-	-	-	-	-	-	-
Injury by firearms	-	-	1	-	-	1	-	-
Injury by cutting or piercing instruments. . .	-	-	-	1	-	2	-	2
Injury by falls	-	-	-	-	-	-	-	-
Traumatism by other crushing (vehicles, rail- ways, landslides, etc.)	-	2	-	-	2	2	1	-
Starvation	-	-	-	-	1	-	-	-
Electricity	-	-	-	-	-	-	-	-
Homicide by firearms.	-	-	-	2	-	-	-	1
Homicide by cutting or piercing instruments .	-	-	-	-	-	-	-	2
Fractures (cause not specified)	-	-	-	1	-	1	-	-
Other external violence:								
Explosions	-	-	-	-	1	-	-	-
Other external violence	-	-	-	-	-	1	-	-
ILL-DEFINED DISEASES:								
Ill-defined organic diseases	-	-	-	-	-	-	1	-
Sudden death	-	-	-	-	-	-	-	-
Infections of undetermined origin.	-	-	-	4	-	2	-	-
Unstated	-	-	-	-	-	-	-	-
TOTAL	1	36	-	25	-	53	1	28
							1	88
							1	69
							1	49
							2	37

BY DISEASE—*Concluded*

Jamaica Division			Panama Division			Preston Division			Tela Railroad			Truxillo Railroad			Semi-total			Total	Deaths in Hospitals		
Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.			Emp.	Non-Emp.	
T. O.	T. O.		T. O.	T. O.		T. O.	T. O.		T. O.	T. O.		T. O.	T. O.		T. O.	T. O.			T. O.	T. O.	
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	1	-
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	1	-
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	1	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1
-	-	2	-	-	-	-	-	-	-	-	1	-	-	1	-	-	5	5	-	-	3
-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	3	3	-	-	2
-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	2	-	-	-
-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-	8	8	-	-	8
-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	3	-	2	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1	-	-	1
-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	2	1	3	-	2	1
-	-	-	-	1	-	-	2	1	-	-	-	-	-	-	-	3	1	4	-	3	1
-	-	-	-	1	-	-	1	1	-	2	2	-	4	2	-	9	1	16	-	9	6
-	-	-	-	-	-	-	1	-	-	2	1	1	2	-	1	10	2	13	1	10	2
-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	1	2	-	3	-	2	-
-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	6	5	11	-	6	5
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	1	-	-	1
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	1	-
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	4	1	5	-	3	1
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	1	4	-	2	1
-	-	-	-	-	1	-	1	1	-	1	-	-	-	-	-	3	3	6	-	2	3
-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	1	3	-	2	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-
-	-	-	-	-	-	-	-	-	-	1	-	-	2	1	-	3	2	5	-	3	2
-	-	-	-	-	3	-	-	-	-	1	-	-	-	-	-	-	3	3	-	-	-
-	-	-	-	-	1	-	1	1	1	1	1	-	1	3	1	7	7	15	1	6	7
-	-	-	-	-	-	-	-	6	-	2	6	-	-	-	-	2	6	8	-	-	-

RECORD OF

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.
	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.
EPIDEMIC, ENDEMIC OR INFECTIOUS DISEASES:								
Tuberculosis of the respiratory system:								
Acute pulmonary tuberculosis	-	-	-	24	-	1	-	-
Other forms of tuberculosis of respiratory organs	-	-	-	-	-	-	-	-
Syphilis (includes syphilitic infection of any organ, tissue or structure of the body):								
Tertiary	-	-	-	-	-	-	-	-
Period not specified	-	-	-	-	-	-	-	-
GENERAL DISEASES NOT INCLUDED ABOVE:								
Cancer or other malignant tumors of the buccal cavity:								
Cancer of the mouth	-	-	-	1	-	-	-	-
Cancer or other malignant tumors of other or un- specified organs	-	-	-	1	-	-	-	-
Beriberi	-	-	-	-	-	-	-	-
DISEASES OF THE NERVOUS SYSTEM AND OF THE ORGANS OF SPECIAL SENSE:								
Cerebral hemorrhage	-	-	-	-	-	-	-	-
Other forms of mental alienation	-	1	-	-	-	-	-	-
Epilepsy	-	1	-	-	-	-	-	-
DISEASES OF THE CIRCULATORY SYSTEM:								
Acute endocarditis and myocarditis:								
Acute myocarditis	-	-	-	-	-	-	-	-
Other diseases of the heart:								
Other chronic diseases of the heart	-	-	-	1	-	-	-	-
Atheroma and other diseases of the arteries	-	-	-	-	1	-	-	-
DISEASES OF THE RESPIRATORY SYSTEM:								
Pneumonia:								
Lobar	-	-	-	-	-	-	-	-
Pleurisy:								
Empyema of thoracic cavity	-	-	-	1	-	-	-	-
Asthma	-	-	-	-	-	-	-	-
Other diseases of the respiratory system (tuber- culosis excepted):								
Others	-	-	-	1	-	-	-	-
DISEASES OF THE DIGESTIVE SYSTEM:								
Cirrhosis of the liver:								
Not returned as alcoholic	-	-	-	2	-	-	-	-
NON-VENEREAL DISEASES OF THE GENITOURINARY SYSTEM AND ITS ADNEXA:								
Acute nephritis (including unspecified under 10 years of age)	-	-	-	1	-	-	-	-
Chronic nephritis (including unspecified over 10 years of age)	-	-	-	1	-	-	-	-
Other diseases of the kidneys and their adnexa (diseases of the kidney in pregnancy not included)	-	-	-	1	-	-	-	-
Diseases of the bladder (except tumors)	-	-	-	1	-	-	-	-
DISEASES OF THE SKIN AND OF THE CELLULAR TISSUE:								
Other diseases of the skin and its adnexa:								
Ulcer of the skin	-	-	-	1	-	-	-	-

REPATRIATIONS

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total				Total
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		
-	-	-	-	-	2	-	1	-	2	-	-	-	12	-	-	-	1	-	-	-	42	-	1	43
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	2
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	1	-	1	2
-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	3	-	-	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1

RECORD OF REP.

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.
	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.
DISEASES OF THE BONES AND OF THE ORGANS OF								
LOCOMOTION:								
Other diseases of the bones and of the organs of								
locomotion	-	-	-	1	-	-	-	-
OLD AGE:								
Old age (senility)	-	-	-	-	-	-	-	-
TOTAL	-	2	-	37	-	2	-	-

RIATIONS—*Concluded*

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi-Total		Total
Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	
T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	T. O.	
-	-	-	-	-	-	-	-	-	-	-	1	1
-	-	-	-	-	1	-	-	-	-	-	1	1
-	-	-	-	-	7	-	2	-	16	-	-	74
-	-	-	5	-	2	-	7	-	1	-	70	74

TREATED IN HOSPITALS

Panama Division			Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total	Deaths in Hospitals			
Emp.			Non-Emp.			Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			
O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.		T.	O.	T.	
-	-	1	-	3	-	-	-	5	1	5	-	-	-	-	-	35	1	42	78	-	8	-	4
-	-	2	-	1	-	2	-	-	-	-	-	-	-	-	2	9	1	10	22	-	2	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
246	4	156	13	181	1	10	9	450	7	141	30	509	4	125	118	2,586	36	924	3,664	1	10	2	13
7	1	10	-	4	-	-	4	128	1	38	18	123	1	39	56	904	16	289	1,265	-	2	-	1
9	-	2	1	7	-	2	-	8	-	1	-	23	-	6	2	69	1	17	89	-	-	-	-
2	-	1	-	-	-	-	4	28	1	11	2	29	-	10	7	79	1	38	125	-	-	-	4
6	-	2	-	7	-	2	-	9	1	14	2	15	-	7	43	362	17	228	650	-	-	-	2
34	-	7	-	-	-	-	-	10	-	2	-	2	-	-	-	75	-	13	88	-	-	-	1
6	-	1	-	3	-	2	-	3	-	1	-	25	1	4	1	57	2	22	82	-	11	-	6
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	1	-	-	-	1	-	2	-	1	-	-	-	-	-	9	-	8	17	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3	3	-	-	-	-
-	-	1	-	-	-	-	2	1	-	3	-	-	-	-	2	1	1	13	17	-	-	-	2
1	-	-	-	-	-	-	-	38	-	4	-	8	1	6	3	72	7	27	109	-	8	-	2
-	-	-	7	19	3	5	1	6	-	10	6	30	-	5	28	300	5	43	376	-	-	-	-
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	3	24	-	-	-	-	29	456	6	31	10	191	2	37	86	1,007	16	160	1,269	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	5	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	4	-	4	-	2	1	34	2	20	2	14	-	7	10	239	10	72	331	-	1	-	2
-	-	-	1	-	-	-	2	57	-	13	-	-	-	-	3	64	-	15	82	1	5	-	2
1	-	1	2	19	-	1	-	39	2	12	-	4	1	1	2	78	3	16	99	-	2	-	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	4	-	2	6	-	-	-	-
3	-	2	-	-	-	-	-	5	-	4	-	3	-	1	4	31	3	20	58	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	9	-	-	9	-	3	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	1	-	-	3	-	-	-	4	-	-	-	1	-	-	-	23	1	1	25	-	-	-	-
1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	4	-	-	-	-
1	-	1	-	35	-	2	-	1	-	-	-	-	-	-	-	41	-	1	42	-	-	-	-
-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	2	-	3	5	-	-	-	-
3	-	2	2	4	-	-	-	-	-	5	1	3	-	3	6	17	-	19	42	2	13	-	16
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Epidemic, Endemic or Infectious Diseases—Continued																				
Rabies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	1	-	3	-	-	-	1	-	1	-	-	-	-	-	-	-	-
Mycoses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Tuberculosis of the respiratory system:																				
Acute pulmonary tuberculosis . .	1	14	-	3	1	28	-	5	1	22	1	17	-	12	-	8	-	-	-	-
Other forms of tuberculosis of respiratory organs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of the meninges or of the central nervous system . .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of the intestines or peritoneum	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of the vertebral column	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Tuberculosis of the joints	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of other organs and structure:																				
Tuberculosis of the skin and subcutaneous cellular tissue . .	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of the bones (except vertebral column)	-	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of the lymphatic system (except the mesenteric and retroperitoneal glands) . .	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of the genitourinary system	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis of other organs	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Disseminated tuberculosis:																				
Acute (including miliary tuberculosis of the lungs, except that specified as chronic or pulmonary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chronic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Syphilis (includes syphilitic infection of any organ, tissue or structure of the body):																				
Primary	-	2	-	-	-	-	1	-	-	13	5	6	-	12	1	8	-	-	-	-
Secondary	-	29	-	2	-	7	-	-	-	122	-	21	-	19	-	5	-	-	-	-
Tertiary	-	14	-	1	1	31	-	-	-	29	-	8	-	23	-	6	-	-	-	-
Hereditary	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Period not specified	-	-	-	-	-	87	1	2	-	5	-	-	-	3	-	3	-	-	-	-
Soft chancre	-	-	-	-	-	27	2	2	-	35	3	6	-	23	2	6	-	-	-	-
Gonococcal infection, except that of the eye or adnexa	1	22	-	4	1	91	5	6	6	109	23	32	1	39	-	17	2	-	-	-
Gonococcal ophthalmia	-	1	-	1	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-
General Diseases Not Included Above:																				
Cancer or other malignant tumors of the buccal cavity:																				
Cancer of the lip	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer of the tongue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer of the mouth	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer of the jaw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer or other malignant tumors of the stomach and liver:																				
Cancer of the pharynx	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer of the esophagus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer of the stomach	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-

TREATED IN HOSPITALS—Continued

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total	Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.	Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.		T.	O.	T.	O.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	1	-	-	2	-	3	-	1	-	1	-	-	1	8	-	5	14	-	4	-	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	
-	12	-	8	1	15	-	5	-	36	2	14	-	11	-	11	4	150	3	71	228	2	23	-	11
-	-	-	1	-	-	-	-	-	1	-	1	-	18	-	2	-	19	-	4	23	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1	-	1	2	-	1	-	1
-	-	-	-	-	2	-	-	-	1	-	-	-	-	-	-	-	4	-	1	5	-	2	-	-
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	2	-	1	3	-	-	-	-
-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	2	-	2	-	3	5	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	1	2	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1	4	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	2	-	-	-	-
-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	2	-	-	-	2	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	-
-	1	-	-	-	-	-	-	-	1	-	3	1	-	-	-	1	2	-	3	6	1	2	-	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	2	-	-	-	-	-	-	1	6	-	-	-	-	-	-	1	35	7	14	57	-	-	-	-
-	4	-	-	-	8	-	1	-	36	-	21	-	1	1	-	-	226	1	50	277	-	1	-	-
131	-	17	-	-	24	-	10	3	46	1	44	-	22	-	12	4	320	1	98	423	-	10	-	2
-	-	3	-	-	-	-	-	-	1	-	1	-	-	-	-	-	3	-	4	7	-	-	-	-
-	28	-	6	-	-	-	-	-	1	-	1	-	-	-	-	-	124	1	12	137	-	2	-	-
-	8	-	2	-	1	-	-	5	38	-	5	-	4	1	2	5	136	8	23	172	-	-	-	-
-	34	-	6	4	18	-	4	2	41	6	19	1	43	3	9	18	397	37	97	549	-	-	-	-
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	4	-	2	6	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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-	2	-	1	-	-	-	-	-	-	-	2	-	-	-	-	-	3	-	4	7	-	2	-	-

TREATED IN HOSPITALS—Continued

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total	Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.	Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.					
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-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	3	-	1	-	1		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-	-	1	-	-	-	-	-	-	-	-	2	-	-	-	-	-	16	16	-	-	-	-		
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-	2	-	5	1	2	1	2	-	3	-	1	1	5	-	2	5	35	2	13	55	-	-		
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2	11	-	6	1	4	-	5	1	-	-	2	-	3	-	2	5	67	-	27	99	-	-		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	-	7	-	-	-		
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-	1	-	-	-	7	-	2	-	-	-	-	18	-	-	-	39	-	3	42	-	-	-		
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-	1	-	-	-	1	-	1	-	-	-	-	-	-	-	1	6	-	1	8	-	-	-		
-	-	-	1	-	-	-	1	-	2	1	1	-	1	-	1	-	7	2	13	22	-	4		
-	3	-	6	-	-	-	-	-	22	-	11	-	1	-	-	2	156	2	42	202	-	1		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-		
-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	1	2	-	1	3	-	-	-		

CLASSIFICATION OF DISEASES

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division		Jamaica Division	
	Emp.		Non- Emp.		Emp.		Non- Emp.		Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
General Diseases Not Included										
Above— <i>Continued</i>										
Diseases of the parathyroid glands	-	-	-	-	-	-	-	-	-	-
Diseases of the thymus	-	-	-	-	-	-	-	-	-	-
Addison's disease (disease of the adrenals)	-	-	-	-	-	-	-	-	-	-
Disease of the spleen	-	-	-	8	1	1	9	2	1	-
Leukemia and Hodgkin's disease:										
Leukemia	-	-	-	-	-	-	-	-	-	-
Hodgkin's disease	-	-	-	-	-	-	-	-	-	-
Alcoholism (acute or chronic)	-	-	-	-	-	3	2	1	14	6
Chronic poisoning by mineral sub- stances	-	-	-	-	-	-	-	-	-	-
Chronic poisoning by organic sub- stances	-	-	-	-	-	-	-	-	-	-
Other general diseases:										
Acidosis	-	-	-	-	1	-	-	-	-	-
Amyloid degenerations	-	-	-	-	-	-	-	-	-	-
Autointoxications	-	-	-	9	13	2	14	-	-	-
Hemophilia	-	-	-	-	-	-	-	-	-	-
Purpura hemorrhagica	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-
Diseases of the Nervous System and of the Organs of Special Sense:										
Encephalitis	-	-	-	-	-	1	-	-	-	-
Meningitis:										
Simple	-	1	1	-	2	1	-	1	3	1
Non-epidemic cerebrospinal men- ingitis	-	-	-	-	1	-	-	-	-	1
Progressive locomotor ataxia (tabes dorsalis)	-	-	-	-	2	-	-	1	2	-
Other diseases of the spinal cord:										
Bulbar paralysis (Duchenne's disease)	-	-	-	-	-	-	-	-	-	-
Paralysis agitans (Parkinson's disease)	-	-	-	-	-	-	-	-	-	-
Acute ascending spinal paralysis (Landry's disease)	-	-	-	-	-	-	-	-	-	-
Myelitis	-	-	-	1	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-
Cerebral hemorrhage, apoplexy:										
Cerebral hemorrhage	-	1	1	-	-	2	3	-	2	-
Cerebral thrombosis and embolism	-	-	-	-	-	-	-	-	-	-
Paralysis (without specified cause):										
Hemiplegia	-	-	-	1	2	1	-	3	4	-
Other forms of paralysis	-	-	-	3	2	-	2	-	-	1
General paralysis (of the insane)	-	-	-	-	-	-	1	1	-	-
Other forms of mental alienation	-	3	1	-	4	-	1	3	-	-
Epilepsy	-	2	-	-	3	-	1	1	-	1
Convulsions (non-puerperal) (5 years and over)	-	1	-	-	-	-	-	-	-	-
Infantile convulsions (under 5 years of age)	-	-	-	-	-	-	-	-	-	-
Chorea:										
Chorea	-	-	-	-	-	-	-	-	-	-
Hysteria and neuralgia	-	4	6	-	10	-	6	6	1	1
Neuritis	-	1	-	1	21	1	-	7	2	1
Softening of the brain	-	-	-	-	-	-	-	-	-	-
Other diseases of the nervous system	-	-	1	2	5	2	1	2	3	2
Diseases of the organs of vision and adnexa:										
Diseases of the eye (except tumor)	-	1	-	-	-	-	-	-	2	1

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.		O.		T.		O.		T.		O.		T.		O.		T.		O.	
Diseases of the Nervous System and of the Organs of Special Sense—Continued																				
Follicular conjunctivitis	-	1	-	-	-	33	2	1	-	13	-	1	1	49	1	7	-	-	-	-
Trachoma	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Tumors of the eye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other diseases of the eye or its adnexa	1	25	-	-	-	22	-	1	-	10	1	4	-	1	1	1	-	-	-	-
Diseases of the organs of hearing and the mastoid process:																				
Diseases of the ear	-	3	-	2	3	10	-	1	-	16	-	2	1	10	3	4	1	-	-	-
Diseases of the mastoid process	-	-	-	1	-	-	-	1	-	2	-	1	-	2	-	1	-	-	-	-
Diseases of the Circulatory System:																				
Pericarditis	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Acute endocarditis and myocarditis:																				
Acute endocarditis	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Acute myocarditis	-	-	-	-	1	1	-	-	-	1	-	-	-	-	-	1	-	-	-	-
Angina pectoris	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Other diseases of the heart:																				
Chronic endocarditis	-	-	-	-	-	-	-	-	-	2	-	-	-	1	1	2	-	-	-	-
Chronic myocarditis	-	2	-	-	-	1	-	1	-	22	1	16	-	3	2	-	-	-	-	-
Other chronic diseases of the heart	-	6	-	4	1	9	1	2	-	9	-	19	-	4	2	5	-	-	-	-
Aneurism	-	-	-	-	-	-	-	-	-	2	-	-	1	2	1	-	-	-	-	-
Atheroma and other diseases of the arteries	-	3	-	1	-	1	-	-	-	1	-	1	-	2	-	1	-	-	-	-
Embolism and thrombosis (except cerebral)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diseases of the veins (varices, hemorrhoids, phlebitis, etc.)	1	1	1	3	1	19	1	6	1	7	-	7	1	10	3	6	-	-	-	-
Diseases of the lymphatic system (lymphangitis, etc.)	-	3	1	2	1	60	2	10	1	53	-	17	6	25	1	8	-	-	-	-
Hemorrhage without determined cause; other diseases of the circulatory system	-	-	-	-	-	1	-	-	-	-	-	1	-	3	-	-	-	-	-	-
Diseases of the Respiratory System:																				
Diseases of the nasal fossae and their adnexa:																				
Diseases of the nasal fossae	-	-	-	-	-	11	-	-	1	2	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	6	-	1	-	4	-	2	-	-	-	-	-	-	-	-
Diseases of the larynx (except tuberculosis and cancer)	-	-	-	-	1	3	-	-	-	-	-	-	-	12	-	9	-	-	-	-
Bronchitis:																				
Acute	1	33	-	15	3	165	-	2	-	27	2	1	7	28	6	20	-	-	-	-
Chronic	-	3	-	-	-	7	-	3	-	4	-	1	-	-	-	2	-	-	-	-
Not otherwise defined (under 5 years of age)	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-
Not otherwise defined (5 years and over)	-	-	-	-	-	-	-	-	1	28	-	5	1	8	-	2	-	-	-	-
Bronchopneumonia (including capillary bronchitis):																				
Bronchopneumonia	-	17	-	19	-	13	-	2	-	7	-	4	-	2	-	1	-	-	-	-
Capillary bronchitis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pneumonia:																				
Lobar	-	16	-	2	-	44	-	1	-	30	-	21	1	56	-	31	-	-	-	1
Not otherwise specified	-	-	-	-	-	3	-	-	-	14	-	13	-	1	-	1	-	-	-	1
Pleurisy:																				
Pleurisy	-	2	-	-	1	23	-	-	-	3	-	2	-	4	-	-	-	-	-	-

TREATED IN HOSPITALS—Continued

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total	Deaths in Hospitals				
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.		T.	O.	T.	O.	
7	-	-	-	10	-	-	-	-	-	-	-	34	-	4	-	1	147	3	13	164	-	-	-	-	
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-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	
12	-	2	-	7	1	1	-	3	15	1	28	-	82	-	16	-	5	174	4	53	236	-	-	-	-
6	-	8	-	2	5	-	1	5	24	1	11	-	37	-	4	-	13	111	4	33	161	-	-	-	-
-	-	-	-	-	-	-	-	-	-	1	1	-	7	-	2	-	-	11	1	7	19	-	-	-	1
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	1	2	-	1	-	1
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3	-	1	-	-	-	-	-	-	2	-	-	-	3	1	-	-	1	10	1	2	14	-	4	1	1
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1	-	2	-	-	1	-	-	-	1	-	1	-	2	-	1	-	-	8	1	6	15	-	3	-	1
4	-	3	-	-	5	-	-	1	3	1	9	-	2	-	3	-	1	42	4	32	79	-	14	2	9
18	1	5	-	-	8	-	1	-	2	-	2	-	-	-	1	-	1	56	4	39	100	-	10	-	7
4	-	-	-	-	4	-	1	-	1	-	2	-	2	-	-	-	1	15	1	3	20	-	4	-	-
2	1	-	-	-	-	1	-	-	2	1	1	-	-	-	3	-	-	11	3	7	21	-	1	-	-
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	-	-	-	1
12	-	4	-	1	-	1	1	-	10	-	4	-	-	-	-	-	6	59	6	32	103	-	-	-	-
16	-	6	-	2	19	1	1	3	86	-	5	2	14	-	3	-	17	276	5	52	350	-	-	-	-
-	-	-	-	-	1	-	-	-	2	-	2	-	1	-	-	-	-	8	-	3	11	-	1	-	-
20	-	14	-	1	-	-	-	-	2	-	4	3	14	-	-	-	6	49	-	18	73	-	-	-	-
2	-	1	-	-	5	-	2	-	2	-	-	1	10	-	3	-	1	29	-	9	39	-	-	-	-
-	-	-	-	-	-	-	-	-	1	-	-	-	4	-	1	-	1	20	-	10	31	-	1	-	1
31	-	11	-	5	32	3	6	-	34	2	31	9	32	1	24	-	25	382	14	110	531	-	-	-	-
2	-	-	-	2	4	-	-	-	2	-	2	-	3	1	1	-	2	25	1	9	37	-	-	-	-
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10	-	3	-	-	3	-	4	-	7	-	19	-	12	-	1	-	1	71	-	53	125	-	16	-	14
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6	-	-	-	2	18	-	3	-	46	-	14	-	58	-	18	-	3	274	1	90	368	1	100	-	37
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	1	14	33	-	2	-	5
3	-	1	-	2	9	-	1	3	45	-	3	-	7	1	1	-	6	96	1	8	111	-	-	-	-

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Total	Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.		T.	O.	T.	O.
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1	6	-	1	2	7	-	1	-	1	-	2	-	4	-	5	5	48	1	24	78	-	-	-	
-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	1	-	2	-	-	-	
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-	1	-	-	-	1	-	1	1	2	-	-	-	-	-	2	1	7	-	3	11	-	-	-	
-	9	-	3	-	14	-	1	4	16	-	3	1	17	-	7	7	110	1	20	138	-	-	-	
-	3	-	3	-	10	-	2	1	2	1	1	-	2	-	-	3	29	2	13	47	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	3	-	-	4	-	-	-	
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	4	-	-	1	
7	17	3	27	6	11	2	32	5	14	12	17	2	4	1	5	37	80	30	121	268	-	-	-	
3	12	1	7	1	4	-	-	-	-	-	1	4	1	-	1	11	34	4	15	64	-	2	1	
-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1	2	-	-	1	
1	1	-	-	1	2	-	-	-	-	-	-	1	6	-	2	4	11	-	2	17	-	-	-	
1	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	2	2	-	3	7	-	-	-	
1	1	-	1	1	6	1	2	-	12	-	2	4	20	-	10	39	98	17	51	205	-	-	-	
1	8	-	-	1	9	-	-	-	2	-	1	2	3	-	-	6	40	1	6	53	-	-	-	
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	
-	3	-	1	2	2	1	3	1	5	2	10	-	2	1	1	5	17	4	18	44	1	1	-	
-	-	-	1	-	-	-	3	-	-	2	8	-	-	-	11	-	-	3	33	36	-	-	2	
4	14	1	1	3	9	-	4	4	34	1	4	5	8	1	7	27	164	14	38	243	-	2	1	
-	28	-	6	-	-	-	1	-	24	-	9	-	26	-	39	3	293	-	123	419	-	-	-	
-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	1	-	2	3	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	2	2	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	8	-	10	-	-	-	-	-	2</															

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.		O.		T.		O.		T.		O.		T.		O.		T.		O.	
Diseases of the Digestive System																				
— <i>Continued</i>																				
Hydatid tumor of the liver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirrhosis of the liver:																				
Returned as alcoholic	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Not returned as alcoholic	-	1	-	-	-	16	-	-	-	1	-	2	-	-	-	-	-	-	-	-
Biliary calculi	-	-	-	-	-	2	-	1	-	2	-	2	-	-	-	1	-	-	-	-
Other diseases of the liver:																				
Abscess of the liver, amebic . . .	-	-	-	-	-	1	-	-	-	1	-	1	-	-	1	-	-	-	-	-
Other diseases of the liver . . .	-	4	-	6	-	25	-	7	2	19	-	13	1	3	-	2	-	-	-	-
Diseases of the pancreas except cancer	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-
Peritonitis of unstated cause . . .	-	1	-	-	-	-	-	2	-	2	1	5	-	-	-	-	-	-	-	-
Other diseases of the digestive system (cancer and tuberculosis excepted)	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-
Non-Venereal Diseases of the Genitourinary System and Its Adnexa:																				
Acute nephritis (including unspecified under 10 years of age) . . .	-	-	-	-	-	10	-	2	-	1	-	-	-	-	-	-	-	-	-	-
Chronic nephritis (including unspecified over 10 years of age) . .	-	5	-	3	-	15	-	2	-	25	-	17	2	16	2	3	-	-	-	-
Chyluria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other diseases of the kidneys and their adnexa (diseases of the kidney in pregnancy not included)	-	1	-	1	1	43	3	15	1	1	1	3	-	-	-	-	-	-	-	-
Calculi of the urinary passages . . .	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Diseases of the bladder (except tumors)	1	3	1	9	-	9	1	3	-	7	2	7	1	-	-	-	1	-	-	-
Diseases of the urethra, urinary abscess, etc.:																				
Stricture of the urethra	-	8	-	-	-	9	-	2	-	5	-	3	-	3	1	1	-	-	-	-
Others	-	-	-	-	-	1	-	3	-	8	-	2	-	3	-	2	-	-	-	-
Diseases of the prostate (except tumors)	-	1	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-venereal diseases of the male genital organs	2	6	-	3	3	24	-	2	1	20	4	6	1	7	-	2	-	-	-	-
Cysts and other benign tumors of the ovary	-	2	-	10	-	2	-	4	-	2	-	2	-	-	-	-	-	-	-	-
Salpingitis or pelvic abscess	-	-	-	7	-	5	2	20	-	3	-	15	-	1	-	4	-	-	-	-
Benign tumors of the uterus	-	1	-	-	1	1	1	5	-	-	-	5	-	1	-	3	-	-	-	-
Non-puerperal uterine hemorrhage . .	-	-	-	3	-	2	-	2	-	-	-	4	-	-	-	1	-	-	-	-
Metritis	-	-	-	4	-	-	-	-	-	4	-	5	-	-	-	-	-	-	-	-
Other diseases of the female genital organs	-	1	1	6	-	4	2	27	-	-	-	11	-	-	2	8	-	-	-	-
Non-puerperal diseases of the breast (cancer excepted)	-	-	-	4	-	-	-	-	-	-	-	3	-	-	-	1	-	-	-	-
The Puerperal State:																				
Accidents of pregnancy:																				
Abortion	-	-	-	16	-	1	-	12	-	-	-	11	-	-	1	5	-	-	-	-
Ectopic gestation	-	-	-	3	-	1	-	1	-	-	-	-	-	-	1	-	-	-	-	-
Other accidents of pregnancy . . .	-	-	-	7	-	-	1	7	-	-	-	14	-	-	-	3	-	-	-	-
Puerperal hemorrhage	-	-	1	2	-	-	-	3	-	1	-	2	-	-	-	1	-	-	-	-
Other accidents of childbirth:																				
Cesarian section	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other surgical operations and instrumental delivery	-	-	-	11	-	-	2	2	-	-	-	5	-	-	-	-	-	-	-	-
Others	-	-	2	22	-	-	-	6	-	-	-	2	-	-	1	4	-	-	-	-

TREATED IN HOSPITALS—Continued

Panama Division			Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Emp.	Non-Emp.		Total	Emp.	Non-Emp.			
	O.	T.		O.	T.		O.	T.		O.	T.		O.	T.		O.	T.			O.	T.	O.	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	5	-	-	5	-	1	-		
-	-	1	-	2	-	1	5	-	-	-	1	-	-	-	26	-	4	30	-	5	-		
1	-	1	-	-	-	-	-	-	2	1	1	-	-	1	6	-	7	14	-	-	1		
-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	3	1	2	6	-	1	-		
3	-	2	-	1	-	-	2	26	-	7	-	22	1	2	5	103	1	39	148	-	1		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2	-	-	-		
-	-	-	-	-	2	-	1	-	1	-	-	1	1	-	4	2	11	17	-	4	1		
11	-	7	1	1	-	2	-	2	3	8	1	1	1	2	3	15	5	21	44	-	-		
3	-	5	-	1	1	4	1	11	-	2	-	1	-	1	1	27	1	14	43	-	3		
9	-	5	-	16	-	7	-	-	-	7	-	2	-	3	4	88	2	47	141	-	14		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6	-	2	-	7	1	13	1	1	1	3	2	-	1	3	5	59	7	41	112	-	3		
-	-	-	-	1	-	-	1	-	-	1	1	2	-	-	3	3	2	1	9	-	-		
4	-	4	-	4	2	7	1	1	2	1	1	4	-	2	5	32	8	33	78	-	1		
17	-	1	1	19	-	1	1	7	-	2	-	2	-	1	2	70	1	11	84	-	1		
5	-	3	-	2	-	1	1	7	-	1	-	-	-	-	1	26	-	12	39	-	-		
8	-	2	-	1	-	1	-	1	-	2	-	-	-	-	-	16	-	5	21	-	-		
11	-	5	1	20	-	8	1	4	-	5	-	6	-	-	9	98	4	31	142	-	-		
1	-	5	-	-	-	3	-	1	-	1	-	-	-	2	-	8	-	27	35	-	-		
3	-	9	-	6	1	7	-	1	-	8	-	2	1	16	-	21	4	86	111	-	-		
1	-	2	-	-	-	5	-	-	-	7	-	-	1	3	1	4	2	30	37	-	-		
-	-	-	-	-	-	-	-	1	-	-	-	-	-	5	-	2	1	15	18	-	-		
-	-	1	-	-	-	-	-	3	15	-	-	-	-	-	-	4	3	25	32	-	-		
6	3	27	-	-	1	20	-	1	7	52	-	-	1	3	-	12	17	154	183	-	-		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	9	9	-	-		
-	1	16	-	-	-	17	-	3	3	18	-	-	1	18	-	4	6	113	123	-	-		
-	-	1	-	-	-	-	-	-	-	4	-	1	-	2	-	2	1	11	14	-	-		
-	-	4	-	-	-	4	-	-	-	12	-	-	-	2	-	-	1	53	54	-	-		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	8	10	-	3		
-	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	4	4	-	-		
-	-	-	-	-	-	2	-	-	2	2	-	-	-	2	-	-	4	24	28	-	-		
-	-	2	-	-	-	1	-	-	2	13	-	-	-	3	-	-	5	53	58	-	-		

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.		T. O.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
The Puerperal State—																				
<i>Continued</i>																				
Phlegmasia alba dolens, puerperal embolism, etc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puerperal septicemia	-	-	-	5	-	1	-	1	-	1	-	3	-	-	-	-	-	-	-	-
Puerperal albuminuria or convulsions	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Childbirth (without other explanation)	-	-	-	-	-	4	2	45	-	-	3	49	-	-	5	6	-	-	-	-
Puerperal diseases of the breast	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	1	-	-	-	-
Diseases of the Skin and of the Cellular Tissue:																				
Gangrene	-	-	-	1	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
Boil, carbuncle, furuncle	1	3	-	-	4	32	-	1	3	32	1	8	3	31	2	11	-	-	-	-
Phlegmon, acute abscess.	1	50	1	14	2	105	2	13	1	85	-	34	2	56	6	17	1	2	1	-
Tinea and alopecia	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Pruritis	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other diseases of the skin and its adnexa:																				
Trichophytosis	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scabies	-	8	-	-	-	-	-	-	-	-	-	-	-	5	-	1	-	-	-	-
Chiggers (pulex penetrans)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red bug	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Pemphigus contagiosus	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mycetoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ground itch	-	-	-	-	-	-	-	-	-	1	-	-	2	4	-	1	-	-	-	-
Filaria medinensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elephantiasis	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Myositis of skin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dhobie itch	-	-	-	-	-	7	-	-	-	6	-	-	-	3	-	1	-	-	-	-
Prickly heat	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-
Ulcer of the skin	-	9	-	1	1	63	1	2	-	87	-	37	3	57	1	27	-	-	-	-
Ainhum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulcerating granuloma of the pudenda	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Impetigo contagiosa	-	-	-	-	-	4	-	-	-	5	1	1	-	-	-	-	-	-	-	-
Urticaria	1	2	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other diseases of the skin and adnexa	-	9	1	-	3	65	1	1	10	60	6	26	2	45	2	18	-	-	-	-
Diseases of the Bones and of the Organs of Locomotion:																				
Diseases of the bones (tuberculosis excepted)	1	-	-	2	-	2	1	1	-	1	-	-	-	-	-	2	-	-	-	-
Diseases of the joints (tuberculosis and rheumatism excepted)	2	3	-	-	-	23	1	5	-	6	-	4	-	3	-	1	-	-	-	-
Other diseases of the bones or organs of locomotion	-	-	-	-	2	45	-	2	-	2	-	-	1	3	-	1	-	-	-	-
Malformations:																				
Congenital malformations (stillbirths excepted):																				
Hydrocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malformations of heart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	2	-	-	-	-
Diseases of Early Infancy:																				
Congenital debility, icterus and sclerema:																				
Marasmus	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-

TREATED IN HOSPITALS—Continued

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total	Deaths in Hospitals				
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.	Non-Emp.	Emp.		Non-Emp.
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.				T.	O.	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	3	-	-	-	-	-	-	1	-	-	-	-	3	-	2	1	15	18	-	1	1	2	
-	-	-	1	-	-	-	1	-	-	-	2	-	-	-	2	-	-	-	7	7	-	-	-	4	
1	-	2	49	-	-	2	10	-	1	6	100	-	1	3	43	1	6	23	302	332	-	-	-	1	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	9	9	-	-	-	-	
-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	2	-	3	6	-	1	-	2	
6	8	-	3	5	17	2	3	-	9	-	1	2	16	-	3	24	148	5	30	207	-	1	-	-	
-	13	-	8	3	45	1	13	9	142	5	36	7	114	2	18	26	612	18	153	809	-	1	-	-	
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	-	2	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	2	-	-	-	-	
-	-	-	-	-	-	-	-	-	10	-	-	-	3	-	1	-	14	-	1	15	-	-	-	-	
-	-	-	-	-	7	-	-	-	11	1	2	-	4	-	1	-	35	1	4	40	-	-	-	-	
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-	4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	7	-	1	8	-	-	-	-	
2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	1	-	6	-	-	-	-	
-	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	19	-	1	20	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	2	3	-	-	-	-	
-	30	-	1	2	27	1	1	-	73	-	14	2	88	1	7	8	434	4	90	536	-	-	-	-	
-	1	-	1	-	2	-	-	-	-	-	-	-	1	-	-	-	4	-	1	5	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	6	-	-	6	-	-	-	-	
-	-	-	4	-	3	-	1	1	1	-	1	2	2	-	1	3	15	1	8	27	-	-	-	-	
-	2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	3	7	-	1	11	-	-	-	-	
9	48	1	10	2	14	1	5	4	39	4	14	3	50	-	3	33	330	16	77	456	-	1	-	-	
-	6	-	1	-	4	-	-	-	4	-	1	-	1	-	3	1	18	1	10	30	-	-	-	-	
1	15	-	4	3	11	1	2	1	12	2	3	-	4	1	1	7	77	5	20	109	-	-	-	-	
-	-	1	-	-	1	-	1	-	112	-	9	1	9	-	-	4	172	1	13	190	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	2	-	4	6	-	-	-	1	
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	4	4	-	-	-	3	

CLASSIFICATION OF DISEASES

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division		Jamaica Division	
	Non-Emp.		Non-Emp.		Non-Emp.		Non-Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Diseases of Early Infancy										
—Continued										
Inanition	-	-	-	-	-	-	1	-	-	-
Icterus	-	-	-	-	-	-	-	-	-	-
Sclerema	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-
Premature birth, or consequence of labor:										
Premature birth	-	-	-	-	5	-	4	-	-	1
Injury at birth	-	-	-	-	6	-	-	-	-	-
Other diseases peculiar to early infancy:										
Asphyxia neonatorum	-	-	-	-	-	-	-	-	-	-
Atalectasis	-	-	-	-	-	-	-	-	-	-
Umbilical infection	-	-	-	-	-	-	-	-	-	-
Umbilical hemorrhage	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	1	-
Lack of care	-	-	-	-	-	-	-	-	-	-
Old Age:										
Old age (senility)	-	-	-	-	-	4	-	4	-	1
External Causes:										
Suicide	-	-	-	-	-	-	-	-	-	-
Poisoning by food	-	-	-	1	5	2	-	1	3	-
Poisoning by venomous animals	-	-	-	-	-	-	13	-	4	-
Other acute poisonings	-	2	-	-	-	1	-	3	-	3
Burns and scalds	-	2	1	1	-	5	-	2	-	7
Mechanical suffocation	-	-	-	-	-	-	-	-	-	-
Absorption of irrespirable or poisonous gas	-	-	-	-	-	-	-	-	-	-
Accidental drowning	-	-	-	-	-	-	-	-	-	-
Injury by firearms	-	1	-	2	-	6	-	3	-	4
Injury by cutting or piercing instruments	4	296	-	15	-	96	1	5	-	147
Injury by falls	7	9	-	5	-	13	-	1	2	18
Traumatism by machines	-	7	-	-	-	1	-	-	-	2
Traumatism by other crushing (vehicles, railways, landslides, etc.)	4	22	-	-	-	8	1	5	-	9
Injuries by animals (not poisoning)	-	2	-	1	-	2	-	1	1	3
Overexertion	-	-	-	-	-	-	-	-	-	-
Starvation	-	-	-	-	-	1	1	-	-	-
Effects of heat	-	-	-	-	-	-	-	-	-	-
Lightning	-	1	-	-	-	-	-	-	-	-
Electricity	-	-	-	-	-	-	-	-	-	-
Homicide by firearms	-	-	-	-	-	1	-	-	-	-
Homicide by cutting or piercing instruments	-	-	-	-	-	-	-	-	-	-
Homicide by other means	-	-	-	-	-	-	-	-	-	-
Infanticide	-	-	-	-	-	-	-	-	-	-
Dislocations	-	2	-	-	1	1	-	1	5	-
Sprains	-	13	1	-	-	6	-	1	-	2
Fractures (cause not specified)	-	3	-	2	1	23	1	16	2	12
Other external violence:										
Criminal abortion	-	-	-	-	-	-	-	-	-	-
Explosions	-	-	-	-	-	-	-	-	-	-
Salvarsan injection	-	-	-	-	-	-	-	35	-	5
Other medicaments (injections)	-	-	-	-	-	1	-	-	-	-
Other external violence	-	-	-	1	3	79	-	15	2	101

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.		O.		T.		O.		T.		O.		T.		O.		T.		O.	
Ill-Defined Diseases:																				
Sea sickness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ill-defined organic diseases	-	-	-	-	-	3	-	-	1	1	-	1	-	-	-	-	-	-	-	-
Sudden death	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*No disease; malingering	3	15	3	44	-	35	-	59	4	27	6	63	5	6	9	35	-	-	-	-
Infections of undetermined origin	1	2	-	-	-	16	-	3	1	16	-	2	2	8	3	5	-	-	-	-
TOTALS	68	1,171	21	461	92	2,914	59	508	133	3,091	105	1,421	196	1,728	162	1,120	11	11	12	3

*NOTE. — Under "No disease; malingering" are included (a) infants born in the Hospital, nursing babies, well mothers who entered the Hospital with ill babies, and babies who were admitted with ill mothers; and (b) patients who were found to be without physical ailment of any kind, or who were malingering.

TREATED IN HOSPITALS—*Concluded*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total	Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.		T.	O.	T.	O.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	1	4	1	2	-	15	-	3	2	23	1	6	32	-	3	-	2
1	13	1	76	6	77	3	27	10	88	27	167	2	3	-	86	31	264	49	557	901	-	-	-	-
-	3	-	1	-	2	-	1	2	36	7	20	2	7	-	7	8	90	10	39	147	1	6	-	7
109	1,456	36	769	123	1,263	43	422	155	3,072	166	1,341	167	2,298	52	874	1,054	17,004	656	6,919	25,633	11	425	13	290

CLASSIFICATION OF DISEASES TREATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Epidemic, Endemic or Infectious Diseases:																				
Malaria or cachexia (No. 5)	40	2,410	38	1,639	2	1,203	13	245	42	1,272	20	358	295	1,523	217	528	18	504	23	35
Influenza (No. 11)	69	589	5	744	5	1,649	8	118	72	1,131	28	185	13	162	8	26	52	437	63	81
Dysentery (No. 16)	2	40	-	26	22	1,254	22	233	-	105	-	47	-	-	-	-	15	17	5	-
Venereal infections (Nos. 38 to 40, inc.)	17	276	2	52	3	1,375	2	272	10	1,094	17	341	-	131	-	58	12	111	15	1
Other endemic or infectious diseases (Nos. 1 to 42, inc. excepting Nos. 5, 11, 16, and 38 to 40)	13	56	5	162	-	56	-	17	11	224	26	51	-	-	-	-	14	88	8	5
General Diseases Not Included Above:																				
Cancer (Nos. 43 to 49, inc.)	-	1	-	3	-	-	-	4	-	3	-	1	-	-	-	-	3	1	-	4
Benign tumors, and tumors not returned as malignant (No. 50)	2	57	-	28	-	12	-	5	-	1	-	-	-	-	-	-	-	17	-	1
Rheumatism or gout (Nos. 51 and 52)	15	388	4	139	4	1,149	-	46	37	1,092	16	87	55	303	31	41	6	143	21	6
Anemia, chlorosis (No. 58)	44	229	37	526	-	121	-	53	-	219	6	55	-	-	-	-	26	143	33	32
Other general diseases (Nos. 43 to 69, inc., excepting Nos. 43 to 52, inc., and No. 58) .	4	44	-	49	-	57	1	102	1	64	4	28	-	-	-	-	8	10	5	5
Diseases of the Nervous System and of the Organs of Special Sense:																				
Diseases of the nervous system (Nos. 70 to 84, inc.)	4	191	21	174	5	725	5	117	19	320	3	100	-	-	-	-	17	146	17	20
Diseases of the organs of vision and adnexa (No. 85)	37	351	6	181	7	406	1	15	12	437	2	102	31	77	12	21	4	99	14	12
Diseases of the organs of hearing and the mastoid process (No. 86)	17	78	1	73	-	75	3	41	3	203	12	37	5	41	3	5	9	50	11	7
Diseases of the Circulatory System:																				
Organic diseases of the heart (Nos. 87 to 90, inc.)	4	76	-	55	-	23	-	25	-	112	7	74	-	-	-	-	-	15	2	-
Other diseases of the circulatory system (Nos. 87 to 96, inc., excepting Nos. 87 to 90, inc.)	11	108	5	94	-	137	-	57	4	254	3	56	-	-	-	-	3	56	7	22
Diseases of the Respiratory System:																				
Bronchitis (No. 99)	122	885	57	916	9	1,006	1	155	65	976	25	223	117	322	51	117	1	5	-	-
Pneumonia and pleurisy (Nos. 100 to 102, inc.) .	6	52	24	88	-	40	-	11	-	4	3	5	-	-	-	-	-	20	26	-
Other diseases of the respiratory system (Nos. 97 to 107, inc., excepting Nos. 99 to 102, inc.)	7	106	15	182	-	234	1	52	11	306	2	109	-	-	-	-	5	54	4	13
Diseases of the Digestive System:																				
Diseases of the mouth and adnexa (No. 108)	3	205	7	238	-	316	10	37	2	270	9	58	19	213	10	111	2	42	18	-
Diarrhea and enteritis (Nos. 113 and 114) . .	11	86	27	405	-	353	-	204	4	141	8	91	-	-	-	2	13	21	4	12
Ankylostomiasis (No. 115)	-	18	1	46	-	124	-	21	-	331	1	81	-	-	-	-	-	2	-	5

IN HOSPITAL DISPENSARIES

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total				Total
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
24	1,104	25	1,553	37	811	13	1,097	262	1,666	353	661	28	391	7	198	748	10,884	709	6,314	18,655
9	80	2	43	67	320	22	559	63	657	130	240	44	248	4	55	394	5,273	270	2,051	7,988
-	5	-	1	2	11	-	14	7	202	14	52	-	7	2	5	48	1,641	43	378	2,110
-	1,685	6	416	11	239	2	107	84	1,248	26	513	13	317	7	139	150	6,476	77	1,899	8,602
-	6	-	22	-	42	-	66	-	39	-	8	-	1	2	13	38	512	41	344	935
-	1	-	2	-	-	-	4	-	-	-	-	-	-	14	1	3	6	14	19	42
17	9	-	12	-	-	-	-	-	-	-	-	2	5	1	35	21	101	1	81	204
21	195	-	23	3	56	1	44	-	-	-	-	-	8	1	18	141	3,334	74	404	3,953
1	31	-	28	-	29	-	92	-	-	-	-	-	8	1	16	71	780	77	802	1,730
1	7	-	2	27	146	35	127	59	490	97	187	-	2	6	6	100	820	148	506	1,574
12	92	10	20	14	173	27	166	7	67	5	29	22	105	14	90	100	1,819	102	716	2,737
9	86	1	36	53	310	13	134	10	211	14	100	33	184	19	54	196	2,161	82	655	3,094
27	27	11	24	-	5	1	28	1	144	9	79	14	52	11	25	76	675	62	319	1,132
1	45	3	38	1	13	-	41	5	80	8	26	-	2	1	12	11	366	21	271	669
13	29	3	35	-	40	-	31	86	387	117	179	5	11	4	12	122	1,022	139	486	1,769
15	211	7	66	75	212	20	305	12	58	9	16	76	227	33	195	492	3,902	203	1,993	6,590
2	2	-	4	-	5	3	19	4	129	14	43	-	-	-	6	12	252	70	176	510
12	216	1	44	20	51	8	67	49	218	53	111	100	631	29	187	204	1,816	113	765	2,898
9	145	12	47	4	208	2	198	13	97	10	38	17	193	7	84	69	1,689	85	811	2,654
3	12	-	20	12	27	34	252	4	72	17	93	10	35	2	57	57	747	92	1,136	2,032
1	2	-	15	-	-	-	4	9	234	25	132	-	-	-	6	10	711	27	310	1,058

CLASSIFICATION OF DISEASES TREATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Diseases of the Digestive System—Continued																				
Other diseases of the digestive system (Nos. 108 to 127, inc., excepting Nos. 108 and Nos. 113 to 115, inc.) . . .	151	1,070	112	1,210	12	1,803	34	542	83	1,613	25	312	151	164	82	111	107	443	97	70
Non-Venereal Diseases of the Genitourinary System and Its Adnexa:																				
Nos. 128 to 142, inc. . . .	43	218	5	563	2	297	9	364	13	415	26	411	-	-	-	-	35	192	19	37
The Puerperal State:																				
Nos. 143 to 150, inc. . . .	-	-	15	272	-	-	-	13	-	-	1	24	-	-	-	-	-	2	1	-
Diseases of the Skin and of the Cellular Tissue:																				
Boil, carbuncle, furuncle . . .	32	255	5	226	-	295	6	35	29	279	4	41	-	8	-	3	16	82	4	6
Phlegmon, acute abscess (No. 153)	30	1,151	51	600	1	335	8	144	4	134	5	23	2	98	4	26	17	83	14	6
Ground itch	5	13	-	43	-	-	-	-	-	10	-	1	-	7	-	14	-	-	-	-
Ulcer of the skin	16	473	6	201	-	459	-	95	20	207	6	30	7	664	2	215	-	70	-	-
Other diseases of the skin or cellular tissue, and adnexa, (Nos. 151 to 154, inc., excepting Nos. 152 and 153, and "Ground Itch" and "Ulcer of the Skin") . .	60	504	103	576	14	933	6	139	77	748	29	172	88	5	56	24	24	85	18	19
Diseases of the Bones and of the Organs of Locomotion:																				
Nos. 155 to 158, inc. . . .	3	54	-	14	2	178	-	42	-	2	2	-	-	-	-	-	-	14	-	-
Malformations:																				
No. 159	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-
Diseases of Early Infancy:																				
Nos. 160 to 163, inc. . . .	-	-	-	53	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	4
Old Age:																				
No. 164	-	2	-	-	-	-	-	-	3	14	1	1	-	-	-	-	-	-	1	-
External Causes:																				
Injury by firearms (No. 183)	-	2	-	-	-	3	-	2	-	-	-	6	-	4	-	-	-	-	-	-
Injury by cutting or piercing instruments, and falls (Nos. 184 and 185)	207	6,261	53	552	-	729	-	47	21	1,141	35	66	10	180	2	56	16	356	24	5
Traumatism by machines and other means (Nos. 187 and 188)	174	682	3	134	-	529	1	28	18	199	-	-	-	-	-	-	5	458	2	2
Dislocations, sprains, fractures (No. 201)	47	197	8	54	2	19	-	26	5	77	2	9	-	-	-	-	21	92	9	6
Other external causes (Nos. 165 to 203, inc., excepting Nos. 183 to 185, inc., 187, 188, and 201)	9	227	19	159	3	501	2	17	43	538	9	94	7	100	5	56	45	177	43	1414
*Ill-Defined Diseases:																				
*Nos. 204 and 205	67	385	121	2,668	-	201	6	183	14	93	5	256	-	-	-	-	2	19	122	266
TOTALS	1,272	17,740	756	13,145	93	16,597	139	3,511	623	14,029	342	3,536	800	4,002	483	1,414	496	4,054	630	2,096

*NOTE.—Under "Ill-defined Diseases" (Charts Nos. 204 and 205) some Divisions have included (a) persons who were found medical examinations of prospective employees and of aliens who were prospective passengers aboard the steamships; (d) was obtained; (e) obstetrical patients who came for periodical examinations; and (f) persons who came to the dispensaries special foods for infants, and other similar articles.

N HOSPITAL DISPENSARIES—*Concluded*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total				Total
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
63	405	40	248	100	674	83	878	89	711	120	312	169	600	56	291	925	7,483	649	3,974	13,031
14	158	15	241	11	80	28	311	27	251	51	239	12	68	47	246	157	1,679	200	2,412	4,448
-	1	-	7	-	-	5	93	-	-	-	-	-	-	-	46	-	3	22	455	480
58	10	-	32	181	29	1	7	44	328	48	126	61	277	5	99	421	1,563	73	575	2,632
9	31	11	88	82	451	2	209	79	431	83	195	98	276	20	256	322	2,990	198	1,547	5,057
-	7	-	1	-	1	3	3	14	97	12	38	9	11	1	5	28	146	16	105	295
-	165	2	32	6	466	-	227	36	909	55	330	18	156	3	25	103	3,569	74	1,155	4,901
30	293	26	198	137	351	45	514	106	1,140	168	395	278	427	60	181	914	4,486	511	2,218	8,129
4	58	4	13	-	15	-	28	-	14	-	4	16	323	3	46	25	658	9	147	839
-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3
-	-	-	10	-	-	-	36	-	-	-	-	-	-	-	5	-	-	-	111	111
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	3	16	2	6	27
-	-	-	-	-	-	-	-	5	115	2	52	-	-	-	5	5	124	2	65	196
-	28	-	26	265	3,094	25	380	14	572	41	201	13	264	5	39	546	12,625	185	1,372	14,728
3	43	-	4	16	716	1	52	-	8	-	1	4	219	-	36	220	2,854	7	257	3,338
3	68	3	46	-	10	-	17	3	58	2	15	10	48	1	10	91	569	25	183	868
28	512	14	122	116	1,504	19	133	-	-	-	-	9	89	2	18	260	3,648	113	2,013	6,034
31	3,040	301	1,619	7	45	3	87	45	147	42	75	304	296	115	310	920	4,226	715	5,464	11,325
70	8,809	497	5,139	1,247	10,134	396	6,332	1,137	10,780	1,525	4,490	1,365	5,481	483	2,835	8,003	91,626	5,251	42,498	147,378

(a) without physical ailment of any kind, or who were malingering; (b) vaccinations against smallpox and typhoid; (c) laboratory examinations made upon request, with no physical examination of the individual from whom the specimen obtained without any stated or ascertained symptoms or physical signs of disease, but who obtained medicines, surgical supplies,

SURGICAL REPORT

BONES, OPERATIONS ON:

	Banes Division	Colom- bia Division	Costa Rica Division	Guate- mala Division	Jamai- ca Division	Pana- ma Division	Preston Division	Tela Rail- road	Truxillo Rail- road	Total	Post- Opera- tive Deaths
Skull, fracture of	-	-	1	1	-	1	1	1	1	6	1
Cranietomy, decompressive	-	-	-	-	-	-	-	1	1	1	-
Cranietomy, exploratory	-	-	-	-	-	-	-	1	-	1	-
Bone graft	-	-	-	-	-	-	-	1	-	1	-
Fractures, simple	21	2	20	7	13	17	27	26	14	147	-
Fractures, comminuted	1	-	-	-	-	-	-	1	3	5	-
Fractures, compound	7	2	1	2	3	2	1	9	3	30	-
Laminectomy	-	-	-	1	-	-	-	-	3	1	-
Operations for reduction of fractures	1	12	1	1	-	-	4	2	3	23	-
Osteotomy	-	3	1	1	-	-	1	1	-	7	-
Osteectomy	-	-	-	-	-	-	1	3	2	6	-
Resection of jaw	-	-	-	-	-	-	1	-	-	1	-
Resection of wrist	-	-	-	1	-	-	-	-	-	1	-
Resection of elbow	-	-	-	-	-	-	-	-	1	1	-
Resection of rib	2	-	1	-	-	-	-	-	-	3	1
Resection, others	-	-	1	-	-	-	-	-	-	1	-
Others	-	5	2	-	-	-	2	-	4	13	-

CHEST, OPERATIONS ON:

Breast abscess, incision of	-	4	1	-	-	1	-	1	5	12	-
Breast, excision of	1	-	-	-	-	-	1	-	-	2	-
Breast and axilla, excision of	1	-	-	-	-	-	1	-	-	2	-
Empyema	-	-	-	-	-	-	3	1	-	1	2
Thoracotomy	-	-	2	1	-	-	-	4	1	11	-
Others	-	4	3	-	-	1	-	8	1	17	-

LAPAROTOMY:

Abdomen, penetrating wound of	-	-	-	-	-	-	1	3	1	5	-
Abscess of liver, laparo-hepatotomy	-	-	1	-	-	-	-	-	-	1	1
Abscess of liver, thoraco-hepatomy	-	-	1	1	-	-	-	-	-	2	-
Abscess of liver, with local peritonitis	33	14	18	18	1	15	70	17	6	192	2
Appendectomy with general peritonitis	3	3	6	1	-	1	2	1	-	17	3
Cholecystectomy	-	1	-	1	-	2	3	-	-	7	-

Cholecystotomy	1	-	-	-	-	-	1	1	1	1	4
Cholecystostomy	1	-	-	-	-	-	1	1	-	1	1
Ectopic gestation.	1	1	-	-	-	-	-	-	3	2	8
Enterectomy	-	-	-	-	-	-	-	-	-	1	1
Entero-enterostomy	-	-	-	-	-	-	1	2	-	2	5
Enterorraphy	1	-	-	-	-	-	-	-	-	-	1
Exploratory	11	-	-	-	-	2	4	6	1	2	26
Gastro-enterostomy	-	1	-	-	-	-	-	4	-	1	6
General peritonitis	1	-	-	-	-	-	-	-	1	-	2
Hysterectomy, supravaginal	9	4	-	-	-	3	3	10	3	2	35
Pan-hysterectomy	2	1	-	-	1	1	-	2	1	1	8
Hystero-myomectomy	3	-	-	-	-	-	-	-	2	-	6
Hysteropexy	1	-	-	-	-	-	-	8	1	3	13
Hysteropexy with perineorrhaphy	-	-	-	-	-	-	-	-	1	-	1
Intestinal obstruction	2	-	-	-	-	-	-	-	1	-	4
Myomectomy	2	2	-	-	-	-	-	1	-	1	6
Ovarian cystectomy	1	3	-	-	-	-	-	-	2	1	12
Oophorectomy	3	3	-	-	-	1	-	23	-	3	36
Paracentesis abdominalis	18	-	4	-	-	-	-	10	-	-	32
Salpingectomy	4	7	4	3	-	-	6	18	2	2	46
Salpingo-oophorectomy	-	8	5	2	-	-	2	10	1	4	32
Splenectomy	-	1	-	-	-	-	-	-	-	1	2
Others	2	5	-	-	-	-	1	11	3	-	22
Gynaecological:											
Abortions	15	1	2	2	-	2	9	9	10	13	61
Births, premature	-	2	2	40	-	-	-	7	4	4	19
Births, normal	28	54	-	-	-	4	46	17	66	39	294
Births, multiple	3	1	-	-	-	-	-	2	1	-	7
Births, forceps operations	9	5	2	-	-	-	-	2	-	4	22
Births, abnormal presentations	4	1	-	-	-	-	-	-	7	2	14
Births, versions	4	4	2	-	-	-	-	3	6	1	20
Births, episiotomy	-	-	-	-	-	-	-	-	3	3	6
Births, Cæsarain operations	-	-	-	-	-	-	-	-	3	-	1
Embryotomy	-	-	-	-	-	-	1	3	-	-	6
Repairs of perineum	-	1	2	-	-	-	-	-	1	-	4
Others	-	4	1	1	-	1	3	6	5	2	22

OBSTETRICAL:

Abortions	15	1	2	2	2	9	10	13	61
Births, premature	—	2	2	—	—	—	4	4	19
Births, normal	28	54	40	4	—	46	66	39	294
Births, multiple	3	1	—	—	—	—	1	—	7
Births, forceps operations	—	5	2	—	—	—	2	4	22
Births, abnormal presentations	9	1	—	—	—	—	7	2	14
Births, versions	4	4	2	—	—	—	6	1	20
Births, episiotomy	—	—	—	—	—	—	3	3	6
Births, Cesarean operations	—	—	—	—	—	—	3	—	6
Embryotomy	—	—	—	—	—	1	—	—	1
Repairs of perineum	—	1	2	—	—	—	1	—	4
Others	—	4	1	1	—	3	5	2	22

SURGICAL REPORT—Continued

	Banes Division	Colom- bia Division	Costa Rica Division	Guate- mala Division	Jamal- ca Division	Pana- ma Division	Preston Division	Tela Rail- road	Trunillo Rail- road	Total	Post- Opera- tive Deaths
GENITOURINARY TRACT:											
Chancroid operations	2	14	749	3	—	—	—	33	—	801	—
Circumcisions	5	22	10	14	—	25	14	10	8	108	—
Curettage uteri	10	29	2	—	—	2	10	8	2	63	—
Cystotomy	1	1	1	2	—	2	—	—	1	8	—
Cystostomy	—	—	—	—	—	1	2	—	—	3	1
Epididymectomy	—	—	—	—	—	—	—	1	—	1	—
Epididymotomy	—	—	—	1	—	—	—	1	2	4	—
Hydrocele, single, radical cure	3	5	5	3	4	1	10	—	2	33	—
Hydrocele, double, radical cure	—	1	4	—	—	—	—	—	—	5	—
Nephrectomy	—	—	—	—	—	—	—	1	—	1	—
Orchidectomy	—	2	—	—	—	1	1	—	—	4	—
Penis, operations on	—	3	2	—	—	—	—	3	—	8	—
Perineorrhaphy	2	13	—	—	—	—	6	1	—	22	—
Perinephritic abscess	—	—	1	—	—	—	—	—	—	1	—
Prostatectomy	—	—	—	2	—	3	—	—	1	6	—
Serotum operations	1	3	3	—	—	4	1	—	—	12	—
Trachelorrhaphy	—	—	—	—	—	1	—	—	—	1	—
Vaginal puncture for pelvic cellulitis	—	6	—	—	—	—	1	1	2	10	—
Vaginal operations	1	17	—	—	—	11	—	2	1	32	—
Varicocele, radical cure	1	—	1	—	—	1	—	—	—	3	—
Vasectomy	—	—	9	—	—	—	—	—	—	9	—
Urethrotomy, internal	2	1	2	—	—	1	—	10	9	25	—
Urethrotomy, external	—	6	3	3	—	2	1	1	2	18	—
Others	—	15	1025	—	—	—	7	—	21	1068	—
HERNIOTOMY:											
Femoral	—	—	1	—	—	—	1	3	1	6	—
Inguinal, single	14	52	21	8	—	15	17	24	11	162	1
Inguinal, double	3	3	2	2	—	1	—	—	—	11	—
Strangulated	1	—	1	—	—	2	1	—	2	7	1
Umbilical	1	—	—	1	—	—	—	1	—	3	—
Ventral	—	2	1	—	—	—	—	1	2	6	—
Others	—	3	1	—	—	—	—	—	—	4	—

ADENECTOMY:

Axillary	1	—	—	—	—	—	—	—	1	—	—
Cervical	2	1	—	—	—	—	—	—	6	—	—
Femoral	—	—	—	—	—	—	—	—	3	—	—
Inguinal, single	40	246	1	1	—	—	—	37	12	366	—
Inguinal, double	5	2	1	15	—	—	—	4	4	20	—

AMPUTATIONS:

Hand	1	1	3	—	—	—	—	—	1	8	—
Forearm	1	1	—	—	—	—	—	1	2	5	—
Arm	1	—	2	—	—	—	—	—	—	4	—
Thigh	2	—	—	—	2	—	—	—	—	4	—
Leg	3	—	1	—	—	—	—	1	2	9	—
Foot	—	4	—	—	1	—	—	—	—	5	—
Digits, multiple	8	16	5	—	—	—	—	15	—	56	—
Others	—	—	—	—	—	—	—	1	—	1	—

JOINTS, OPERATIONS ON:

Arthrotomy	1	—	4	—	—	—	—	8	2	20	—
Reduction of dislocation	37	8	1	3	—	—	—	1	5	60	—
Others	—	7	—	—	—	—	—	6	4	21	1

MUSCLE AND TENDONS, OPERATIONS ON:

Tenorrhaphy	3	8	3	—	—	—	—	1	2	24	1
Others	—	1	—	—	—	—	—	—	—	1	—

RECTUM, OPERATIONS ON:

Fistula in ano	3	4	—	—	—	—	—	—	3	24	—
Hemorrhoids	4	5	5	1	13	6	—	16	9	77	—
Ischiorectal abscess	—	7	—	2	—	2	—	—	—	14	1
Prolapsus recti	—	3	—	—	—	1	—	—	—	4	—
Others	—	1	—	—	—	—	—	—	—	6	—

MISCELLANEOUS:

Abscesses, treatment of	319	489	303	49	61	193	254	481	2,390	—	—
Aneurism, operation for	—	—	—	—	1	—	—	2	4	—	—
Blood transfusions	—	9	—	—	—	—	5	—	14	—	—
Carbuncles, treatment of	122	237	—	—	7	7	31	4	437	—	—

SURGICAL REPORT—*Concluded*

MISCELLANEOUS—Continued

	Bancs Division	Colom- bia Division	Costa Rica Division	Guate- mala Division	Jamai- ca Division	Pana- ma Division	Preston Division	Tela Rail- road	Truxillo Rail- road	Total	Post- Opera- tive Deaths
Cysts	2	31	34	8	2	7	6	1	7	98	—
Fistulous tracts	—	6	—	1	—	1	—	2	1	11	—
Injections intravenous	222	2,178	2,242	704	—	2,579	616	1,041	399	9,981	—
Nails, extirpation of	5	—	16	2	5	—	1	—	6	35	—
Neoplasm, excision of, benign	3	—	4	—	1	2	3	7	7	27	—
Neoplasm, excision of, malignant	—	—	—	—	—	1	2	4	1	8	—
Phrenectomy	—	—	—	—	—	2	—	—	—	2	—
Plastic operations for severe injuries	—	1	1	1	—	5	—	—	8	16	—
Plastic operations for effects of disease	—	—	1	—	—	—	—	—	4	5	—
Plastic operations for congenital defect	—	—	—	—	—	—	—	—	2	2	—
Removal of foreign body	2	2	6	—	2	8	8	19	9	56	—
Skin graft	—	—	1	1	—	1	—	—	—	3	—
Snake bite, treatment of	—	—	6	11	—	—	—	3	3	23	—
Thyroidectomy	—	—	—	—	—	—	1	—	1	2	—
Tooth-extraction	65	92	658	329	22	143	293	24	479	2,105	—
Ulcers, treatment of	62	8	1,797	580	—	2	68	48	147	2,712	—
Vaccinations	10,766	—	89	3	1,354	139	2	2	32	12,387	—
Varicose veins, treatment	4	3	1	1	—	3	1	—	—	13	—
Wounds, gunshot	2	4	2	22	—	3	2	54	17	106	—
Wounds, scalds and burns	55	—	372	64	—	—	33	20	2	546	—
Wounds, stab	—	—	4	106	—	1	1	85	2	199	—
Wounds, others	1,441	17	1,781	277	17	31	1,323	70	84	5,041	1
Various other minor operations	3	36	213	29	—	130	6	60	44	521	—
Various other major operations	—	15	—	—	—	—	—	—	1	16	—

EAR, OPERATIONS ON:

Abscess, incision of	—	2	3	—	1	—	1	2	—	9	—
Mastoid operations	1	2	—	3	—	1	—	—	7	14	—
Paracentesis of membrane tympani	—	—	18	—	—	—	—	—	1	19	—
Removal of foreign bodies	17	—	66	87	1	1	1	25	5	203	—
Others	2	—	22	22	—	—	—	—	2	48	—

EYE, OPERATIONS ON:

Abscess, incision of	-	3	-	-	-	-	-	-	-	5	-	-
Cataract, extraction of	-	1	-	-	-	-	-	-	-	12	-	-
Chalazion, excision of	-	-	-	-	-	-	-	-	-	3	-	-
Enucleation	1	2	1	1	-	-	-	-	-	11	1	-
Hordeolum	-	1	-	-	-	-	-	-	-	5	2	-
Iridectomy	-	-	-	-	-	-	-	-	-	2	-	-
Lid operations	-	3	-	-	-	-	-	-	-	10	2	-
Pterygium, excision of	-	-	-	-	-	-	-	-	-	2	-	-
Pterygium, transplantation of	-	-	-	-	-	-	-	-	-	28	-	-
Removal of foreign body	48	141	8	-	-	-	-	-	-	355	3	-
Trachoma, treatment of	22	-	-	-	-	-	-	-	-	23	-	-
Others	9	1	-	-	-	-	-	-	-	17	6	-

NOSE AND THROAT, OPERATIONS ON:

Adeno-tonsillectomy	1	11	3	-	-	-	-	-	-	78	1	-
Peritonsillar abscess, incision of	-	1	4	-	-	-	-	-	-	11	2	-
Removal of polypi	-	-	1	-	-	-	-	-	-	2	-	-
Sinus operations	-	-	1	-	-	-	-	-	-	1	-	-
Tonsillectomy	5	13	3	-	-	-	-	-	-	88	7	-
Tracheotomy	-	-	1	-	-	-	-	-	-	2	-	-
Turbinectomy	-	-	-	-	-	-	-	-	-	2	-	-
Others	1	1	-	-	-	-	-	-	-	5	1	-
GRAND TOTAL	13,455	10,554	3,180	2,701	1,486	3,416	3,112	2,255	2,042	42,201	35	-

CONSOLIDATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.
BLOOD EXAMINATIONS:																
Total examinations . . .	2,512	-	1,922	-	4,612	-	930	-	10,806	-	836	-	3,243	-	1,925	-
Leucocyte enumerations	87	-	24	-	145	-	16	-	207	-	42	-	156	-	2	-
Differential leucocyte counts	2	-	4	-	15	-	7	-	59	-	13	-	156	-	2	-
Erythrocyte enumerations	6	-	7	-	4	-	6	-	36	-	15	-	156	-	2	-
Hemoglobin estimations	10	-	6	-	4,042	-	792	-	4,638	-	362	-	114	-	-	-
Malaria	2,375	-	1,873	-	3,558	-	669	-	5,656	-	392	-	2,661	-	1,919	-
(a) Estivo-autumnal	-	460	-	103	-	468	-	68	-	695	-	45	-	734	-	27
(b) Tertian	-	9	-	13	-	187	-	64	-	947	-	61	-	141	-	12
(c) Quartan	-	13	-	2	-	12	-	1	-	18	-	4	-	7	-	-
(d) Mixed infection	-	1	-	-	-	5	-	2	-	24	-	2	-	30	-	1
Filaria	-	-	-	-	-	-	-	-	-	-	-	7	-	1	-	-
Sugar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Widal tests	29	19	8	5	80	13	11	3	113	34	5	3	-	-	-	-
Other examinations	3	1	-	-	17	-	2	-	97	23	-	2	-	-	-	-
URINE EXAMINATIONS:																
Total examinations	1,704	-	421	-	4,121	-	794	-	6,071	-	707	-	4,391	-	261	-
Albumin	1,465	208	331	68	1,609	-	232	-	1,088	-	100	-	4,372	1,033	261	4
Casts	166	49	56	13	1,353	-	132	-	619	-	33	-	692	-	2	-
Pus	166	44	9	6	1,286	-	260	-	1,181	-	123	-	881	-	4	-
Blood	63	41	15	9	1,302	-	185	-	140	-	20	-	60	-	-	-
Sugar	24	10	23	7	688	4	65	10	50	-	18	-	10	-	-	-
Hemoglobin	6	6	-	-	1	1	-	-	18	-	-	-	64	-	-	-
Gonococci	-	-	-	-	25	8	18	2	8	-	7	-	2	-	-	-
B. tuberculosis	2	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Other examinations	15	12	-	-	179	191	54	32	207	-	14	19	19	-	-	-
SPUTUM EXAMINATIONS:																
Total examinations	50	-	17	-	376	-	104	-	1,155	-	104	-	478	-	30	-
B. tuberculosis	50	13	16	3	47	-	30	-	68	-	13	-	478	50	30	-
Pus	-	-	-	-	350	-	90	-	845	-	58	-	76	-	-	-
Blood	-	-	3	4	34	-	11	-	95	-	12	-	65	-	-	-
Other examinations	1	1	-	-	-	-	1	1	6	-	2	-	25	-	-	-
STOOL EXAMINATIONS:																
Total examinations	1,526	-	391	-	2,466	-	657	-	5,124	-	557	-	4,243	-	286	-
Uncinaria	622	198	66	35	1,614	-	82	-	1,736	-	117	-	4,227	1,445	286	-
Trichuris	509	297	246	137	1,140	-	129	-	875	-	75	-	1,210	-	-	-
Ascaris	436	245	79	56	590	-	66	-	481	-	43	-	1,256	-	-	-
Oxyuris vermicularis	9	2	-	-	-	-	13	-	24	-	5	-	19	-	-	-
Strongyloides stercoralis	39	16	19	8	63	-	29	-	192	-	15	-	198	-	-	-
Tenia saginata	1	1	-	-	-	-	-	-	5	-	2	-	8	-	-	-
Tenia solium	-	-	-	-	-	-	-	-	3	-	2	-	6	-	-	-
Other tape-worms	-	-	-	-	12	-	7	-	12	-	-	-	1	-	-	-
Entameba histolytica	41	9	6	1	951	-	342	-	159	-	42	-	155	-	-	-
Other entamebae	37	16	-	1	112	-	27	-	78	-	13	-	19	-	-	-
Balantidium coli	1	1	20	15	31	-	1	-	10	-	5	-	44	-	-	-
Flagellates, intestinal	18	14	11	4	569	-	169	-	260	-	41	-	124	-	-	-
Blood	23	14	-	-	179	-	57	-	264	-	30	-	200	-	-	-
Pus	23	15	-	-	165	-	53	-	257	-	51	-	268	-	-	-
Other examinations	5	-	-	-	1	2	-	1	15	-	4	16	16	-	-	-
MISCELLANEOUS SMEARS:																
Total examinations	13	-	9	-	162	-	209	-	*335	-	202	-	616	-	118	-
Eye	1	-	1	-	32	23	6	4	-	9	-	10	60	46	1	-

LABORATORY REPORT

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad			
Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.	Hosp. Total	Pos.	Hosp. Disp. Total	Pos.
14	-	61	-	10,705	-	7,187	-	2,771	-	2,678	-	11,631	-	-	-	6,564	-	2,509	-
1	-	1	-	445	-	65	-	203	-	8	-	543	-	-	-	316	-	22	-
2	-	1	-	339	-	57	-	78	-	3	-	180	-	-	-	314	-	47	-
1	-	1	-	108	-	38	-	3	-	-	-	19	-	-	-	76	-	2	-
1	-	17	-	2,241	-	461	-	213	-	31	-	757	-	-	-	112	-	39	-
9	-	41	-	7,537	-	6,548	-	2,264	-	2,636	-	9,836	-	-	-	5,781	-	2,331	-
-	2	-	3	-	1,980	-	696	-	363	-	692	-	1,731	-	-	-	1,222	-	438
-	4	-	22	-	114	-	42	-	9	-	79	-	522	-	-	-	290	-	186
-	-	-	-	-	77	-	24	-	17	-	2	-	42	-	-	-	40	-	16
-	-	-	-	-	25	-	5	-	-	-	-	-	79	-	-	-	60	-	19
-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	31	-	-	-	-	-	-	-
-	-	-	-	9	1	-	-	9	4	-	-	98	9	-	-	-	-	-	-
-	-	-	-	26	-	18	-	-	-	-	-	18	-	-	-	6	4	-	-
17	-	487	-	5,129	-	721	-	2,162	-	673	-	6,056	-	-	-	4,232	-	641	-
4	3	183	14	5,129	2,762	721	182	-	525	-	117	-	1,202	-	-	-	1,642	-	164
-	-	10	6	5,129	1,528	721	143	-	245	-	21	-	970	-	-	-	432	-	32
-	-	3	3	5,129	4,353	721	650	-	474	-	117	-	1,010	-	-	-	2,372	-	426
-	-	1	-	4,850	266	691	18	-	76	-	19	-	208	-	-	-	412	-	71
11	5	174	8	991	16	137	8	-	10	-	11	-	16	-	-	-	-	-	1
-	-	-	-	505	10	77	-	-	6	-	-	-	2	-	-	-	48	-	-
-	-	-	-	5	3	-	-	-	-	-	-	-	37	-	-	-	-	-	-
-	-	-	-	7	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-
2	2	116	55	3,521	126	259	41	7	7	2	2	-	34	-	-	23	112	3	2
-	-	9	4	149	-	8	-	132	-	22	-	463	-	-	-	336	-	20	-
-	-	9	3	149	22	8	-	-	23	-	8	-	83	-	-	-	70	-	12
-	-	-	-	8	-	-	-	-	5	-	-	-	-	-	-	-	23	-	-
-	-	-	-	8	-	-	-	-	6	-	-	-	-	-	-	-	4	-	-
-	-	-	1	-	-	-	-	5	5	-	-	-	-	-	-	-	-	-	-
3	-	66	-	3,459	-	141	-	1,177	-	149	-	5,587	-	-	-	3,710	-	152	-
-	-	42	3	3,459	494	131	17	-	175	-	12	-	1,815	-	-	-	1,892	-	60
-	-	-	2	3,459	893	141	38	-	149	-	14	-	2,551	-	-	-	1,247	-	81
-	-	-	5	3,459	322	141	19	-	98	-	16	-	2,174	-	-	-	546	-	44
-	-	-	-	3,161	8	113	-	-	1	-	-	-	-	-	-	-	-	-	-
-	-	-	-	3,419	242	121	3	-	38	-	-	-	221	-	-	-	1	-	-
-	-	-	-	2,801	-	113	-	-	2	-	1	-	-	-	-	-	2	-	-
-	-	-	-	2,639	-	113	-	-	-	-	-	-	-	-	-	-	3	-	-
-	-	-	-	2,639	-	113	-	-	-	-	-	-	33	-	-	-	-	-	-
-	-	2	-	2,229	19	92	2	-	20	-	1	-	207	-	-	-	21	-	-
-	-	-	-	2,671	40	91	-	-	8	-	-	-	496	-	-	-	-	-	-
-	-	-	-	2,639	3	113	-	-	-	-	-	-	23	-	-	-	3	-	-
-	-	-	-	3,199	34	113	1	-	5	-	1	-	462	-	-	-	-	-	-
3	1	22	13	2,627	42	133	4	-	29	-	3	-	340	-	-	-	97	-	-
-	-	-	-	2,627	102	115	7	-	30	-	2	-	201	-	-	-	121	-	1
-	-	-	-	561	67	1	-	-	-	-	-	-	765	-	-	1	15	-	-
2	-	9	-	118	-	70	-	22	-	15	-	498	-	-	-	266	-	108	-
-	-	-	-	7	1	10	3	-	-	-	-	45	30	-	-	-	-	-	1

CONSOLIDATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Hosp. Total	Pos.	Hosp. Total	Pos.	Hosp. Total	Pos.	Hosp. Total	Pos.	Hosp. Total	Pos.	Hosp. Total	Pos.	Hosp. Total	Pos.	Hosp. Total	Pos.
MISCELLANEOUS SMEARS—																
Continued																
Throat	3	1	—	—	8	8	16	14	—	4	—	2	5	3	—	—
Gums and mouth . .	1	1	—	—	3	2	—	—	—	3	—	—	—	—	—	—
Nose	1	—	—	—	5	—	10	1	—	4	—	2	10	8	3	1
Ear	—	—	—	—	5	—	—	—	—	—	—	2	15	8	—	—
Genital source (gonococcus)	4	—	7	2	25	11	155	61	—	54	—	43	504	321	111	58
Cutaneous ulcer . .	—	—	—	—	70	40	2	1	—	19	—	2	22	15	3	1
Other smears	3	1	1	1	14	1	20	2	—	45	—	20	—	—	—	—
EXAMINATION FOR SYPHILIS:																
Total examinations . .	157	—	150	—	3,754	—	1,339	—	1,589	—	494	—	491	—	109	—
Complement fix. test (blood)	—	—	—	—	1,933	791	669	214	—	590	—	140	—	—	—	—
Flocculation test (blood)	—	—	—	—	1,799	786	659	222	—	107	—	44	458	234	98	37
Dark-field examination	—	—	—	—	—	—	8	4	—	5	—	1	33	19	11	6
Spinal-fluid test . .	157	85	150	38	30	7	7	—	—	11	—	—	—	—	—	—
CULTURES:																
Total examinations . .	59	—	26	—	315	—	53	—	285	—	66	—	82	—	3	—
Blood	21	14	7	4	87	15	4	1	—	20	—	4	13	11	2	—
Urine	—	—	—	—	70	34	4	2	—	15	—	3	6	3	—	—
Sputum	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Stool	19	2	15	—	122	7	18	3	—	15	—	8	2	2	—	—
Fluid from joint . .	1	1	—	—	1	—	—	—	—	—	—	—	23	12	—	—
Spinal fluid	4	3	—	—	4	—	2	—	—	2	—	—	10	9	—	—
Pleural fluid	2	2	—	—	1	—	—	—	—	1	—	—	11	11	—	—
Throat	5	4	3	2	10	10	17	11	—	3	—	1	1	1	—	—
Other sources	3	1	—	—	18	5	8	5	—	10	—	5	5	5	—	—
Autopsy sources . .	1	—	—	—	2	—	—	—	—	—	—	—	11	11	1	—
MISCELLANEOUS:																
Total examinations . .	—	—	—	—	23	—	30	—	1,222	—	1,670	—	32	—	—	—
Autopsies performed . .	—	—	—	—	2	—	1	—	—	—	—	—	32	—	—	—
Surgical tissues reported	—	—	—	—	16	—	2	—	—	—	—	—	—	—	—	—
Reports of progress on special problems	—	—	—	—	19	—	—	—	—	—	—	202	—	—	—	—
Number of X-ray examinations	32	—	53	—	306	—	15	—	408	—	—	—	409	—	45	—
Others	—	—	—	—	5	1	27	—	—	171	—	153	1	—	—	—

* Total smears from ulcers 45; positive for Leishmania tropica, 16; Vincent's spirochaetae, 5; mixed Leishmania and Vincent's, 4.

LABORATORY REPORT—*Concluded*

Jamaica Division				Panama Division				Preston Division				Tela Railroad		Truxillo Railroad			
Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.	Hosp. Total	Hosp. Disp.
-	-	-	-	6	1	1	1	1	-	1	-	9	2	-	-	-	1
-	-	1	1	1	-	-	-	-	-	-	-	5	5	-	-	-	-
-	-	-	-	5	1	3	1	5	-	3	1	1	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
2	2	8	7	81	36	55	14	10	7	11	7	409	118	-	-	86	55
-	-	-	-	18	1	1	1	-	-	-	-	28	19	-	-	28	11
-	-	-	-	-	-	-	-	6	4	1	1	1	1	-	-	149	87
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	1,246	-	592	-	396	-	206	-	3,339	658	-	-	753	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	1,212	494	592	233	393	146	206	48	3,314	657	-	-	656	86
-	-	-	-	6	1	-	-	3	1	-	-	19	-	-	-	3	-
-	-	-	-	28	13	-	-	-	-	-	-	6	1	-	-	3	-
-	-	-	-	38	-	2	-	-	-	-	-	582	-	-	-	30	-
-	-	-	-	16	-	-	-	-	-	-	-	86	15	-	-	15	2
-	-	-	-	3	-	-	-	-	-	-	-	36	23	-	-	4	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	1	-	-	-	-	-	70	23	-	-	-	-
-	-	-	-	1	-	-	-	-	-	-	-	5	1	-	-	-	-
-	-	-	-	2	-	-	-	-	-	-	-	10	5	-	-	2	1
-	-	-	-	4	-	-	-	-	-	-	-	2	-	-	-	-	-
-	-	-	-	6	-	1	-	-	-	-	-	347	71	-	-	-	-
-	-	-	-	6	-	-	-	-	-	-	-	25	21	-	-	1	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	2
-	-	-	-	110	-	1	-	-	-	-	-	67	12	-	-	89	-
-	-	-	-	43	-	1	-	22	-	-	-	28	-	-	-	79	-
-	-	-	-	18	-	-	-	18	-	-	-	15	12	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	296	-	-	-	295	-	-	-	898	-	-	-	321	-
-	-	-	-	49	3	-	-	2	-	-	-	10	-	-	-	7	2

*NUMBER AND CLASSIFICATION OF X-RAY EXAMINATIONS

Nature of Examination	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division		Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		*Total	
	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used	Number of Examinations	Plates and Films Used
Vertebral column	1	2	10	12	4	13	11	14	1	1	5	5	6	6	1	6	3	5	39	55
Skull	1	2	27	41	41	67	25	33	1	1	4	4	5	6	6	6	21	35	130	188
Sternum	3	3	9	10	3	4	5	6	1	1	1	1	1	1	2	2	19	24	54	56
Ribs	28	30	63	68	101	117	87	109	1	1	56	67	67	70	37	37	57	65	496	526
Upper limbs	16	17	100	135	89	114	93	134	1	1	74	76	88	97	62	62	74	99	596	672
Lower limbs	1	1	1	1	4	10	4	6	1	1	2	3	1	2	4	4	31	48	12	22
Neck	4	4	29	61	34	143	12	30	1	1	68	103	19	19	19	19	31	48	201	408
Teeth	5	1	35	36	2	2	6	6	1	1	58	6	66	79	362	362	81	85	385	16
Heart	26	21	1	1	46	61	131	140	1	1	1	46	1	1	392	392	1	1	835	468
Lungs	1	1	1	1	3	3	2	1	1	1	1	1	1	1	1	1	1	1	8	6
Liver	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3
Spleen	1	1	2	2	1	1	1	1	1	1	1	1	2	2	8	8	1	1	55	77
Kidney	1	1	18	35	5	9	15	24	1	1	7	7	2	2	16	16	10	19	104	162
Gastrointestinal tract	1	1	14	31	6	24	29	48	1	1	4	4	25	37	16	16	14	15	70	98
Pelvic organs	2	2	7	8	15	25	19	31	1	1	3	3	12	16	9	9	10	10	79	8
Miscellaneous	2	2	5	5	49	49	1	1	1	1	4	6	1	1	1	1	1	1	1	1
TOTAL	85	80	321	441	403	593	454	593	1	1	296	331	295	338	898	898	321	396	3,073	2,772

* NOTE.—The figures appearing in the "Total" column, under the heading "Plates and Films Used," are incomplete, inasmuch as the Tela Railroad Company's Medical Department has not supplied data in their reports to record the number of plates and films used in the Tela Hospital in examining the respective organs. Fluoroscopic examinations are included in the columns entitled "No. of Examinations."

METEOROLOGICAL REPORT

AVERAGE TOTAL RAINFALL (INCHES)

MONTH:	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division	Jamaica Division	Panama Division	Preston Division	Tela Railroad	Trustillo Railroad	Average for All Divisions
January	4.29	.00	20.27	9.67	2.02	10.89	5.39	18.28	11.22	-
February . . . . .	.46	.00	10.94	6.27	1.42	10.42	.84	5.92	4.33	-
March	1.00	.57	4.40	3.05	1.18	3.74	1.41	1.19	4.89	-
April	1.78	.70	7.58	5.06	2.89	8.34	5.41	6.42	5.14	-
May	10.91	6.74	4.49	4.07	7.06	5.54	7.71	1.59	3.44	-
June	1.27	5.95	18.76	14.19	5.50	14.12	2.54	9.48	7.78	-
July . . . . .	.75	1.80	17.08	13.04	3.21	14.40	1.70	7.07	9.13	-
August	6.67	7.99	9.49	9.22	12.10	5.82	7.02	6.56	5.45	-
September	2.86	8.69	6.68	8.36	6.55	2.65	4.95	6.10	5.17	-
October	8.31	7.79	13.19	10.46	9.09	7.28	4.76	7.07	11.00	-
November	2.45	8.39	22.80	14.28	6.68	16.59	2.99	25.57	17.15	-
December	4.62	.03	13.72	8.02	6.51	10.51	4.47	10.56	13.04	-
TOTALS	45.37	48.65	149.40	105.69	64.21	110.30	49.19	105.81	97.74	86.26

MEAN TEMPERATURE (FAHRENHEIT)

January	67.00	79.50	73.50	74.00	74.00	79.00	69.00	72.50	73.50	-
February	72.00	83.00	74.00	77.50	74.50	78.00	72.00	76.00	75.00	-
March	70.00	82.00	74.00	82.00	75.50	77.50	71.50	76.50	78.50	-
April	75.00	83.00	74.50	86.00	74.50	77.50	77.00	80.50	81.50	-
May	74.00	83.00	77.00	82.00	74.50	79.50	77.50	78.50	80.00	-
June	78.00	82.00	76.00	85.00	76.50	78.50	78.00	80.00	82.00	-
July	78.50	83.00	76.50	82.00	77.00	79.00	78.00	79.00	80.50	-
August	81.00	81.00	76.00	82.50	76.50	78.50	77.00	79.50	80.00	-
September	82.50	82.50	77.00	83.00	74.50	79.50	79.00	80.50	83.00	-
October	77.50	82.00	76.50	81.00	74.50	78.50	77.50	78.50	79.00	-
November	75.50	80.50	76.50	76.50	74.50	78.50	75.50	75.50	77.00	-
December	69.50	81.50	74.00	75.00	71.50	77.50	70.50	70.50	77.50	-
Average maximum temperature	89.17	94.92	90.50	97.92	87.00	87.58	93.00	92.92	89.83	-
Average minimum temperature	60.92	68.92	60.42	63.17	62.67	69.33	57.42	61.67	68.08	-
Average mean temperature	75.04	81.92	75.46	80.54	74.83	78.46	75.21	77.29	78.96	-

GENERAL STATEMENT PASSENGER SERVICE

NEW YORK PASSENGER STEAMSHIPS

	Calamaries	Car-rillo	Meta-pan	Pas-tores	Santa Marta	Six-aola	Tivives	Tolosa	Ulua	Zacapa	Total
Number of voyages made	13	13	12	13	13	13	13	13	13	13	129
Total number of officers, all voyages	290	247	228	290	247	247	247	298	329	247	2,670
Total number in crews, all voyages	1,385	882	826	1,342	891	885	892	1,372	1,464	888	10,827
Total number of ships' laborers, all voyages	213	227	211	167	213	250	236	161	209	246	2,133
Number of seamen given physical examination before "signing-on"	1,382	882	814	1,312	877	893	887	1,376	1,334	884	10,641
Number of rejected applicants, "signing-on" day	19	4	2	4	1	13	7	29	12	9	100
Number of prospective passengers rejected at tropical ports	—	—	—	—	—	—	—	—	—	—	—
Number of cabin passengers carried	3,415	2,287	2,479	3,391	2,650	2,358	2,290	3,296	3,150	2,660	27,976
Number of deck passengers carried	482	907	836	513	848	750	1,038	530	512	919	7,335
OFFICERS, CREWS AND SHIPS' LABORERS:											
Total number of patients treated	574	141	132	140	325	224	222	282	368	192	2,600
Total number of treatments in office	1,006	262	211	320	421	338	357	545	676	297	4,433
Total number of treatments in quarters	71	60	17	65	91	75	73	157	58	75	742
PASSENGERS:											
Total number of patients treated	186	95	94	62	100	183	100	115	121	119	1,175
Total number of treatments in office	192	106	131	47	89	271	200	98	113	129	1,376
Total number of treatments in staterooms	183	91	109	97	72	203	144	145	107	93	1,244
Number of vaccinations	19	366	174	12	182	165	285	6	8	81	1,298
Number of persons detained by quarantine and immigration authorities	10	1	5	24	3	7	9	6	4	4	73
*Number of deaths	—	—	—	—	4	1	—	—	—	1	6

* The deaths aboard steamships of the New York Division were caused by: acute dilatation of heart, 2; angina pectoris, 1; acute nephritis, 1; myocarditis, 1; drowning, 1.

	Aban- garez	Atenas	Car- tago	Cas- tilla	Coppe- name	Here- dia	Irtona	Paris- mina	Sara- macca	Suri- name	*Tela	Tur- rialba	Total
Number of voyages made . . .	24	24	18	8	17	17	11	17	17	18	15	23	209
Total number of officers, all voyages	443	447	345	120	309	322	165	323	308	327	226	430	3,765
Total number in crews, all voyages	1,247	1,339	1,089	346	739	1,057	466	1,040	738	777	628	1,267	10,733
Total number of ships' labor- ers, all voyages	145	89	98	141	188	142	149	157	182	147	58	102	1,598
Number of seamen given phys- ical examination before "signing-on"	1,222	1,323	1,072	331	734	1,046	465	1,017	727	764	622	1,253	10,576
Number of rejected applicants, "signing-on" day	10	3	3	2	14	10	8	4	11	7	3	15	90
Number of prospective pas- sengers rejected at tropical ports	1	-	-	-	-	-	-	3	-	-	-	1	5
Number of cabin passengers carried	2,051	2,260	2,687	346	1,052	2,693	546	2,568	977	1,098	927	2,144	19,349
Number of deck passengers carried	117	248	322	18	494	208	71	316	380	481	2	275	2,932

OFFICERS, CREWS AND SHIPS'

LABORERS:

Total number of patients treated	452	430	610	151	464	442	215	669	654	355	238	270	4,950
Total number of treatments in office	617	525	799	229	577	587	282	1,025	1,043	439	333	383	6,839
Total number of treatments in quarters	36	47	33	31	56	54	29	39	85	18	16	78	522

PASSENGERS:

Total number of patients treated	76	105	226	23	116	136	25	174	69	38	45	41	1,074
Total number of treatments in office	79	92	237	20	114	135	31	311	82	32	51	40	1,224
Total number of treatments in staterooms	43	40	183	14	35	97	10	147	45	31	49	26	720

Number of vaccinations	80	67	127	1	147	155	30	45	90	-	61	288	1,091
Number of persons detained by quarantine and immigra- tion authorities	10	10	10	3	5	10	1	6	6	3	5	5	74
**Number of deaths	-	-	1	-	-	-	-	-	-	1	-	-	2

* These records include one trip made between New Orleans, La., and New York, N. Y.

** The deaths aboard steamships of the New Orleans Division were caused by: cerebral hemorrhage, 1; drowning, 1.

*CLASSIFICATION OF DISEASES TREATED ABOARD PASSENGER STEAMSHIPS AND BY PORT MEDICAL OFFICERS
AT NEW YORK, NEW ORLEANS AND BOSTON

	Steamships N. Y. Division		Steamships N. O. Division		Port Med. Officer New York		Port Med. Officer New Orleans		Port Med. Officer Boston		Revere Sugar Refinery Boston	
	Crew	Pass.	Crew	Pass.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.	Emp.	Non- Emp.
Endemic or infectious diseases (Charts Nos. 1 to 42, incl.) . . .	156	52	165	29	58	-	18	1	4	-	-	-
General diseases not included above (Charts Nos. 43 to 69, incl.) . . .	65	35	46	17	18	-	5	2	5	-	22	-
Diseases of the nervous system and organs of special sense (Charts Nos. 70 to 86, incl.)	214	96	146	45	91	4	39	3	45	-	293	-
Diseases of the circulatory system (Charts Nos. 87 to 96, incl.) . . .	101	54	6	8	16	-	6	4	3	-	13	-
Diseases of the respiratory system (Charts Nos. 97 to 107, incl.) . . .	306	124	551	116	88	-	81	3	26	-	239	-
Diseases of the digestive system (Charts Nos. 108 to 127, incl.) . . .	468	288	2,311	391	97	-	102	5	43	-	631	-
Non-venereal diseases of the genito- urinary system and its adnexa (Charts Nos. 128 to 142, incl.) . . .	21	18	20	19	10	-	7	-	2	-	4	-
The puerperal state (Charts Nos. 143 to 150, incl.)	-	5	-	1	-	-	-	-	-	-	-	-
Diseases of the skin or cellular tis- sue (Charts Nos. 151 to 154, incl.)	117	43	360	83	100	1	59	4	59	-	163	-
Diseases of the bones and organs of locomotion (Charts Nos. 155 to 158, incl.)	151	66	28	-	21	-	11	1	10	-	77	-
Malformations (Chart No. 159) . . .	-	-	-	-	-	-	-	1	-	-	-	-
Diseases of early infancy (Charts Nos. 160 to 163, incl.)	-	-	-	-	-	-	-	-	-	-	-	-
Old age (Chart No. 164)	-	-	-	-	-	-	-	-	-	-	-	-
External causes (Charts Nos. 165 to 203, incl.)	931	175	758	100	723	14	592	7	324	-	1,642	-
Ill-defined diseases (Charts Nos. 204 and 205, incl.)	89	226	559	265	18	-	213	3	-	-	-	-
TOTAL	2,619	1,182	4,950	1,074	1,240	19	1,133	34	521	-	3,084	-

*NOTE: This table gives only cases treated, and does not show the number of treatments.

There were no cases of quarantinable diseases aboard our steamships during the year. There were no cases of trachoma; 3 cases of venereal diseases among the passengers, and 41 cases among members of the crews.

The chart numbers used are taken from the "International List of Causes of Sickness and Death." These chart numbers are used universally by public-health and city and state health departments and organizations.

The figures for the "Steamships, New York Division," include cases treated during one voyage each of the S.S. "Triona" and the S.S. "Tela," 15 Crew and 4 Passengers; and S.S. "Tela," 4 Crew and 3 Passengers.

REPORT OF PORT MEDICAL OFFICERS AND SANITARY INSPECTOR

MEDICAL AND SURGICAL CASES TREATED

Port	Medical Cases			Surgical Cases			Total	
	No. of Cases Emp.	Non-Emp.	No. of Treatments	No. of Cases Emp.	Non-Emp.	No. of Treatments	No. of Cases	No. of Treatments
New York	318	2	373	922	17	3,398	1,259	3,771
New Orleans	479	19	811	654	15	1,911	1,167	2,722
Boston {	Long Wharf . . .	197	277	324	—	609	521	886
	Revere Refinery	1,442	413	1,642	—	2,658	3,084	3,071
GRAND TOTAL	2,436	21	1,874	3,542	32	8,576	6,031	10,450

PHYSICAL EXAMINATION OF PROSPECTIVE EMPLOYEES

Port	Total No. Examined	Total No. Rejected	Per Cent Rejected
New York	953	229	24.03
New Orleans	514	50	9.73
Boston	424	42	9.91
TOTAL	1,891	321	16.98

PHYSICAL EXAMINATION OF MEMBERS OF CREWS

Port	Total No. Examined	Total No. Rejected	Per Cent Rejected
New York	13,824	252	1.82
New Orleans	10,799	98	.91
Boston	2,853	9	.32
TOTAL	27,476	359	1.31

PHYSICAL CAUSES FOR REJECTION OF MEMBERS OF CREWS

	New York	New Orleans	Boston		New York	New Orleans	Boston
Syphilis, primary	—	8	—	Diseases of the kidneys and its			
Syphilis, tertiary	—	1	—	adnexa	1	—	—
Syphilis, period not specified . .	9	—	—	Non-venereal diseases of the			
Soft chancre	10	13	3	male genital organs	20	1	—
Gonococcal infection except				Boils	3	—	—
that of the eye or adnexa	70	40	2	Scabies	5	—	—
Anemia	3	—	—	Dhobie itch	5	—	—
Trachoma	—	3	—	Other diseases of the skin and			
Other diseases of the eye or its				adnexa	20	2	—
adnexa	8	2	—	Diseases of the bones or organs			
Aneurism	1	—	—	of locomotion	2	—	—
Hemorrhoids	5	—	—	Acute poisonings	1	—	—
Acute bronchitis	1	—	—	Injury by cutting or piercing			
Diseases of the lymphatic				instruments	3	—	—
system	—	10	—	Traumatism by crushing	3	—	—
Diseases of the teeth and gums	13	1	—	Ill-defined organic diseases . .	1	—	—
Tonsillitis	5	—	—	No diseases; malingering	1	—	—
Ulcer of the stomach	1	—	—	Infections of undetermined			
Hernia	60	17	3	origin	1	—	1
				TOTAL	252	98	9

VACCINATIONS

New York	44
New Orleans	657
Boston	43

FUMIGATION

	New York	New Orleans	Boston
Steamships fumigated throughout	36	49	15
Holds only	—	—	—
Superstructure only	—	1	—
Forward quarters	5	2	1
Aft quarters	5	3	7
Separate rooms	10	9	7

EXPLANATORY NOTES

A list of abbreviations as used in the tables in Section VI—with their meanings—is given herewith:

M.—Male
F.—Female
T.—White persons born in temperate zones
O.—All persons other than “white persons born in temperate zones”
Emp.—Employee
Non-emp.—Non-Employee
Pass.—Passenger
O.—Office Calls
V.—Visits
N. Y.—New York
N. O.—New Orleans

Referring to the names of certain divisions which do not indicate the name of the country where located, the following explanation is given: Banes and Preston Divisions are located in Cuba; the Tela Railroad Company and the Truxillo Railroad Company in Honduras; and the Chiriqui Land Company in Panama.

The chart numbers referred to in some of the tables are taken from the “International List of the Causes of Sickness and Death.” These chart numbers are used universally by public-health and city and state health departments and organizations.

The term “Employees” includes all persons appearing on our payrolls, including laborers and others employed on a part-time or hourly basis.

The term “Non-Employees” includes all persons formerly indicated by the classifications “Members of Families of Employees” and “Other Non-Employees”—i.e., all persons not included in the term “Employees.”

In the present Report it will be noted that a change has been made in the method of classifying persons dependent upon the Company for medical attention. In reports issued prior to 1924 the subdivisions were based upon races—white and colored. This classification has been discontinued in the present Report, and patients are separated into two groups—(1) White persons born in temperate zones, and (2) “Others”—the latter including all individuals, *irrespective of color or race*, except white people with nativity in temperate zones. This method will make possible, for those interested, a determination of the effects of climatic conditions on people born in temperate zones and residing in a tropical climate. Of course, the separate groupings of “employees” and “non-employees,” male and female, have been continued. It may be stated that the 1924, 1925, 1926 and 1927 Reports were compiled on the same basis as the present Report.

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